Aug. 1929

Electrical Manufacturing

Vol. 4 A Gage Publication No. 2

Your products, too, can be permanently and colorfully identified as in this product of Airmaster, by using Meyercord Transfer Nameplates

THE MEYERCORD CO.
1147 State Bank Bldg., Chicago

YOU CAN HAMMER THE BELDEN SOFT RUBBER PLUG- IT WONT BREAK
You can bang the Belden Soft Rubber Plug against a fine piece of furniture. It will not scratch the furniture or hurt the plug.
Belden

Inserting ordinary plugs in receptacles that do not fit perfectly often causes breakage. Prongs of the Belden Soft Rubber Plug spread or come together to fit the receptacle without breakage.

Fig. 1

For example, a strong pressure with the fingers will force the prongs together (Fig. 1) but they come right back to the correct position when released (Fig 2). In service the receptacle holds the prongs rigidly in position. (Listed as standard by Underwriters.)

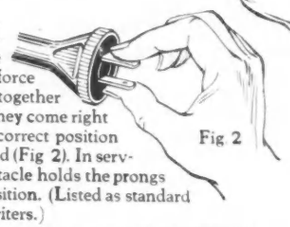


Fig. 2

Belden Soft Rubber Plugs Eliminate Breakage!

"TWENTY-FIVE to thirty plugs per day were replaced because of breakage during or after assembly when we used ordinary plugs," said a large radio manufacturer. "Since standardizing on Belden Soft Rubber Plugs we have not had to replace or adjust a single plug, either in our plant during assembly or in the hands of our dealers."

This experience is typical of manufacturers who adopt the Belden Soft Rubber Plug as standard. Dealers appreciate this Belden Soft Rubber Plug because it eliminates troublesome service calls and complaints due to breakage which frequently occur with the ordinary type of plug. Users appreciate the unbreakable feature because it eliminates annoyance and expense from broken plugs.

Write today for complete information about the Belden Soft Rubber Plug and the Belden Cut Cord Service for electrical manufacturers.

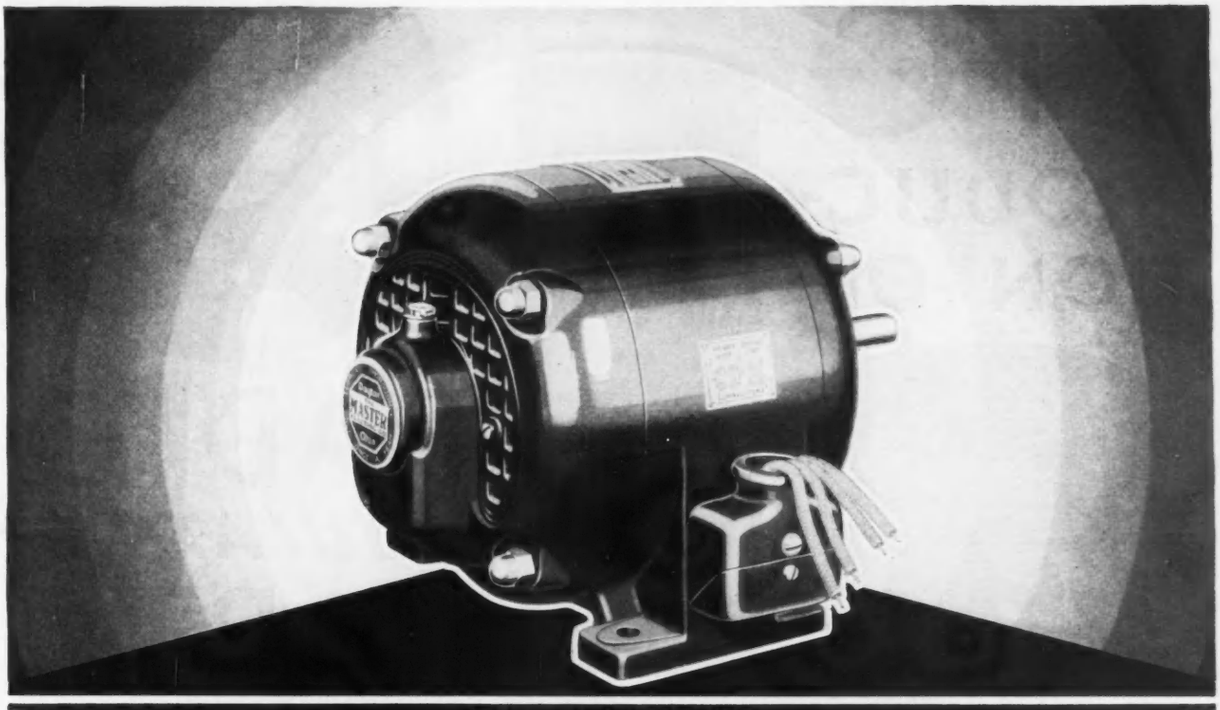
BELDEN PRODUCTS

Beldenamel and Textile Magnet Wire
Coil Windings
Beldenmold
(Molded Bakelite Products)
Automotive Wires and Cables
Airplane Assemblies
Radio Wires, Cords and Cables
Rubber Covered Wires
Armored Cables
Flexible Armature Wires
Motor Lead Wires
Braided and Stranded Copper Cables
Cotton Sleeving

Belden Manufacturing Company

2310-B South Western Ave. Chicago, Ill.

Specify Belden



It's the Unusual that Brings Out MASTER Quality

ALMOST any motor will operate under average conditions and give a certain degree of satisfaction. It takes unusual, abnormal conditions to prove its worth.

Ability to meet the unusual and conquer it, is built into every Master Motor.

Each week, twenty Master Motors are selected, at random, from the current week's production and subjected to strenuous tests that border on sheer abuse. The cause for the slightest failure to meet these tests is immediately rectified. Thus Master quality is upheld.

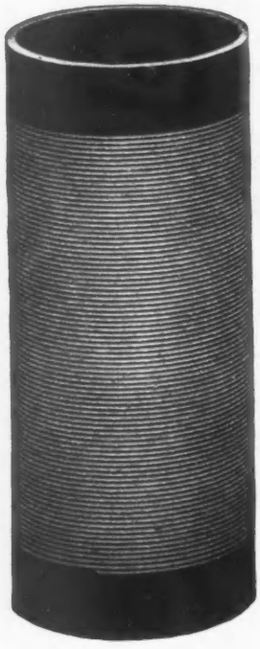
Before you buy a motor—determine for yourself whether it will stand up under hard starting—poor location—low voltage—overload—lack of proper lubrication—lack of proper operating inspection.

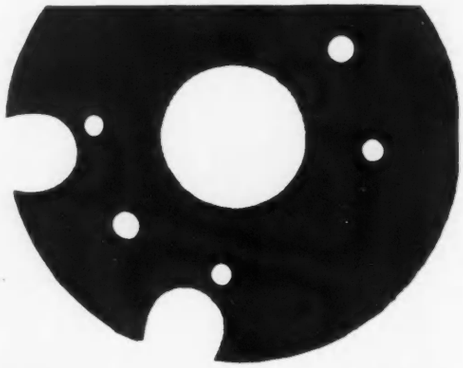
Users of Master Motors will tell you that Master Motors deliver *genuine* satisfaction.

THE MASTER ELECTRIC COMPANY
Dayton, Ohio
Manufacturers of Master Guaranteed Motors

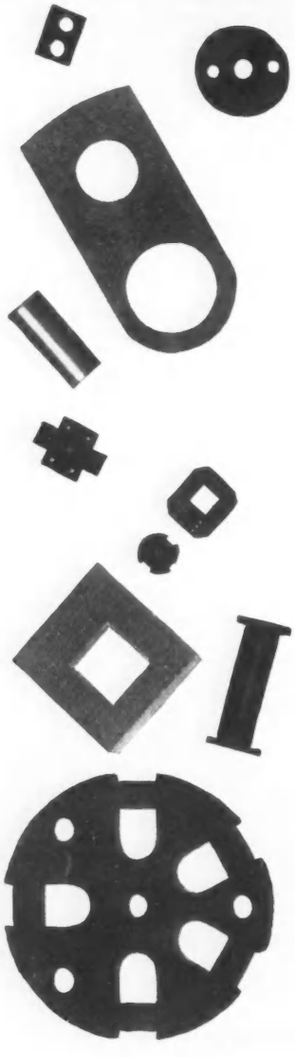
STOCKS CARRIED IN PRINCIPAL CITIES
1/20 TO 10 H.P.
Dayton THE MASTER ELECTRIC CO. Ohio
MORE THAN 100 SERVICE STATIONS
NOT MORE THAN 40°

BIG PRODUCTION OF





RADIO *INSULATING* PARTS



THE production of insulating parts for radio receivers is now getting into full swing at the Formica plant.

A large, new sheet press, several new tube machines and presses, and important additions to the machining equipment have been made since last year to enable Formica to keep up with the very large demands the trade is making on the Formica factory.

This large and always growing equipment makes it possible for Formica to give manufacturers the best of service - - - and a uniform and thoroughly efficient material.

Send your blue prints for quotations

THE FORMICA INSULATION COMPANY
4626 Spring Grove Avenue Cincinnati, Ohio

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

Electrical Manufacturing

Reg. U. S. Patent Office

Volume 4 AUGUST, 1929 Number 2

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William W. Baxter, *Associate Editor* — Roger L. Knight, *Associate Editor*

Irwin Robinson, *News Editor* — Edward H. Dutcher, *Production Editor*

Electrical Manufacturing's editorial program has the following objectives:

Production

To help all electrical manufacturers, including makers of motor-driven products, increase the product's salability, cut unit production costs, quicken turnover, reduce overhead expenses, establish standard methods of work, and spread a better knowledge of raw materials and parts.

Marketing

To spread a better knowledge of and aid electrical manufacturers in adjusting sales management to the buyers' market, to aid in making advertising more effective, finding the most profitable distribution channels, and promoting cooperative market development.

Administration

To further the working out of sounder management policies and better executive control, coordinating sales and production schedules, promoting research, and developing better industry relations.

Repairing

To help all motor repair shops to build better business by developing a sounder organization, improving management, policies and methods, and developing a keener merchandising point-of-view on the business.

Contents of This Issue

Standardization Aids the Industry ..... *L. L. Elden* 23
Suggestions for Designing Springs ..... *L. D. Granger* 26
Rod and Wire Forming Data and Methods ..... *J. K. Olsen* 30
Electrical Instruments for Aircraft ..... *V. E. Whitman* 32
Here's a Market for Electrical Equipment 34
Cost Analysis of Electric Heating Problems ..... *R. M. Cherry* 36
Auxiliary Apparatus in Electric Heating 39
Motors and Control in Brick Making 42
"Service" in Motor Repairing ..... *William W. Baxter* 43
Checking and Testing Motor Applications ..... *D. H. Braymer* 46
Specifications in Purchasing Materials ..... *R. H. Arnold* 48
Spray Finishing Fundamentals ..... *Paul W. Collins* 49
Editorials 52
Characteristics Determining the Selection of Motors ..... *Theodore Schou and C. P. Robinson* 54
Asbestos—Its Electrical Uses ..... *William C. Hirsch* 57
Electric Drill Components 59
Facts, Figures, and Trends 60
Legal Aspect of Implied Guarantees ..... *Leo T. Parker* 61
Nema News 63
Industrial Control Standards 64
Electrical Manufacturing News 72
Index of Raw Materials, Parts and Electrical Equipment 84

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NOT A PRODUCT .. BUT A PROCESS

CORROSION . . . THE ENEMY OF INDUSTRY

THE relentless march of the enemy of industry, corrosion, works to tear down and destroy what a hundred thousand artisans have striven to create. All metal is subject to corrosion in some degree, and nowhere does corrosion find an easier field for its destructive activities than in the automobile you drive from day to day, through heat and cold, and rain and sleet.

That is why motor car manufacturers rust-proof virtually all metal parts against the ravages of corrosion. A majority of them as well as thousands in varying industries use the UDYLITE rust-proofing process because of its unparalleled efficiency and because of the handsome silver gray finish it imparts to all metals on which it is used.

Udylite
RUST PROOFS
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The UDYLITE PROCESS COMPANY

Eastern Sales Office:
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Now is the time to learn about G-E Glyptal Lacquers

REG. U.S. PAT. OFF.

Unusual Finishes for Metal Surfaces

G-E GLYPTAL lacquers adhere to all surfaces, including galvanized iron and aluminum, with a tenacity which is unexcelled. This explains, in part, why G-E Glyptal lacquers are unusually desirable coverings for metal products.

Moreover, G-E Glyptal lacquers are time-saving, money-saving finishes. They eliminate priming and sizing operations in the finishing of metal surfaces. G-E No. 1451 filler, recommended for use with Glyptal lacquers, possesses priming characteristics. The lacquers themselves function as both primer and sizer.

G-E Glyptal lacquers are now available in five colors: red, blue, green, brown, and aluminum—other colors to follow. Essentially, all have the same distinctive qualities. Besides preventing rust, they resist alkalies, weak acids, salt spray, mineral oils, gasoline, and kerosene; they have high dielectric strength; and they stand extremely high temperatures without discoloration.

G-E Glyptal lacquers are applied by spraying, dipping, or brushing; air-dry quickly; and form smooth, tough, yet flexible finishes. Let the G-E Merchandise Distributor nearest you explain more about G-E Glyptal lacquers. If you prefer, fill in and mail the coupon below.

800-525

JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY AT 8 P.M., E.S.T. ON A NATION-WIDE N.B.C. NETWORK

GENERAL ELECTRIC

MERCHANDISE DEPARTMENT, BRIDGEPORT CONNECTICUT

WRITE FOR *test strip and folder*

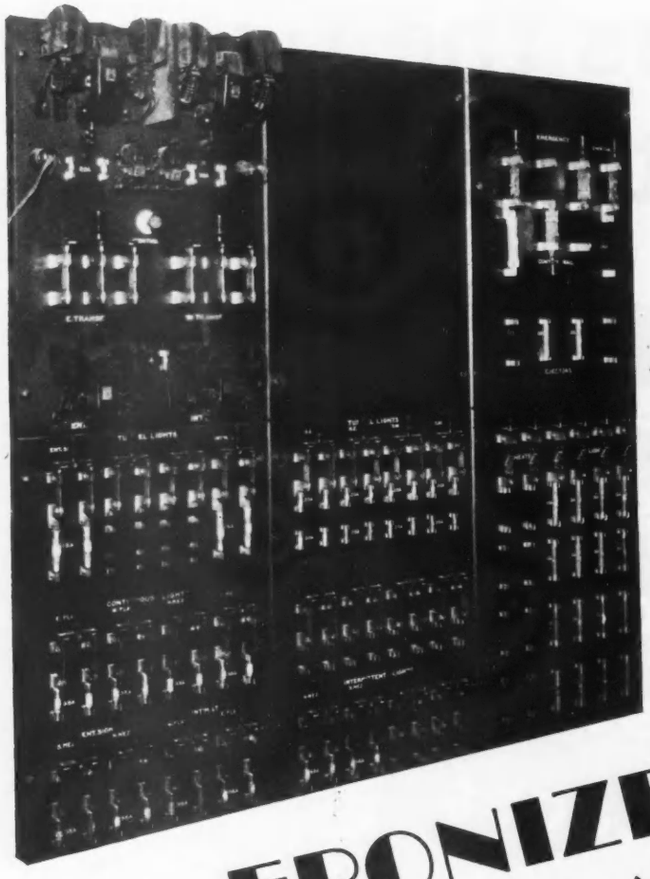
Merchandise Department,
General Electric Company,
Bridgeport, Conn.
Gentlemen:

I wish to make my own experiments. Please send the G-E Glyptal lacquer test strip and more detailed information about these new protective finishes.

_____

_____

_____



AMBLER EBONIZED ASBESTOS LUMBER

The Ideal Switchboard Material!

Good-looking—Stands the "Gaff"

The choice of leading electrical engineers because of its superior dielectric strength and physical properties. It is approved by the Underwriters' Laboratories and meets all the severe specifications of the Bureau of Engineering of the U. S. Navy.

Ambler Asbestos Products

Electrical manufacturers everywhere use Ambler Asbestos Products because they are fireproof, enduring, attractive, and made according to the most accurate specifications. In addition to Ambler Ebonized Asbestos Lumber, you can use to advantage Ambler Asbestos Shingles, Ambler Asbestos Lumber (plain or impregnated), Corrugated Roofing and Siding, Waltile and Ambler Cold Moulded Products.

Ambler Asbestos Shingle & Sheathing Co.

AMBLER, PENNA. : ST. LOUIS, MO.

"that's just what we wanted"—

explained the superintendent to the General Manager of an electrical manufacturing plant. "We've been experimenting around with different makes of coils long enough, now let's stick to these Dudlos and play safe. Those people sure know how to make trouble-free coils if anyone does, and that's the only kind we want in our product."

"You're the doctor," said the G. M., "the best is none too good when it comes to coils. We all know that."

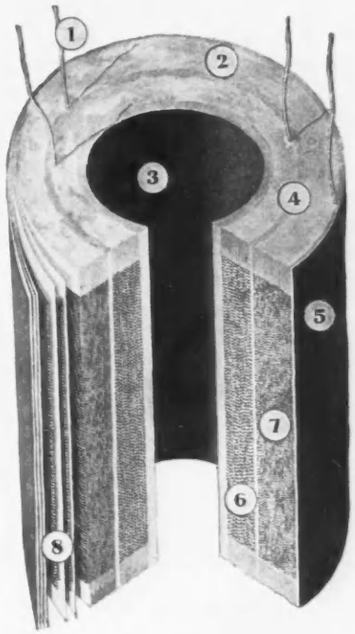
"Seems to me there's another reason why Dudlo is entitled to the business," the engineer interrupted. "They've always been so accommodating on samples for our experimental models and they have given us many valuable suggestions, too."

The G. M., turning to his pile of morning mail, added, "Well, I'm glad you boys have the coil question settled. Issue your requisitions and get them in early—it's all right with me."

DUDLO MANUFACTURING COMPANY, FORT WAYNE, IND.
Division of General Cable Corporation

Dudlo Coil Construction

1. Insulated, flexible leads—carefully spliced and anchored.
2. Coil impregnated throughout and ends sealed with highest grade insulating compound.
3. Tough, heavy tube, insulating core from laminations.
4. Special insulation between primary and secondary.
5. Protecting wrapper as specified.
6. Primary winding.
7. Secondary winding.
8. Paper insulation between every layer.



DUDLO

"THE COIL'S THE THING" IN RADIO AND ELECTRICAL APPARATUS

HORSE HEAD ZINC

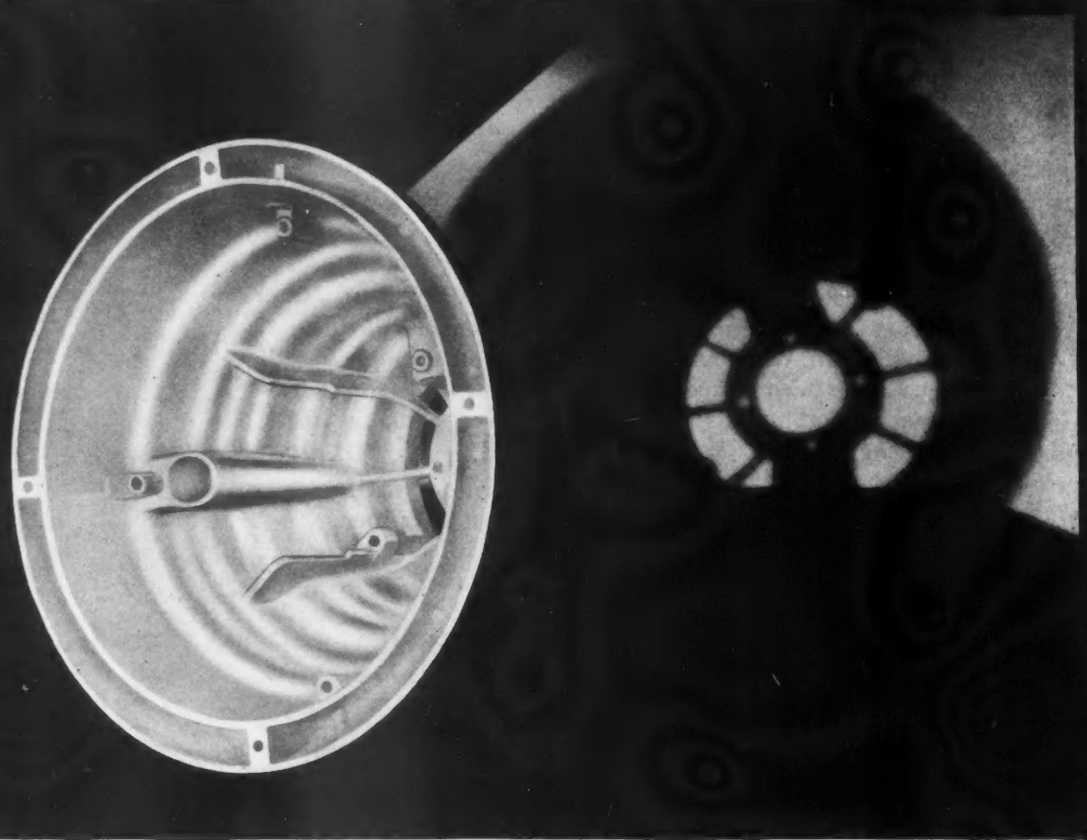
FOR THE DIE CASTING INDUSTRY

Strength + Utility

This generator housing is not a combination of castings, reinforcing members, extruded pieces, machined surfaces, and numerous bolts, nuts and screws.

This generator housing is a single zinc base die casting. Its strength . . . its design . . . its lack of applied parts . . . its general utility . . . immediately mark it as such.

This zinc base die casting is made with Horse Head—*uniform quality*—Zinc. This Horse Head Zinc assures die-casting strength . . . facilitates die-casting design . . . emphasizes the general utility of die casting.



New Jersey Zinc

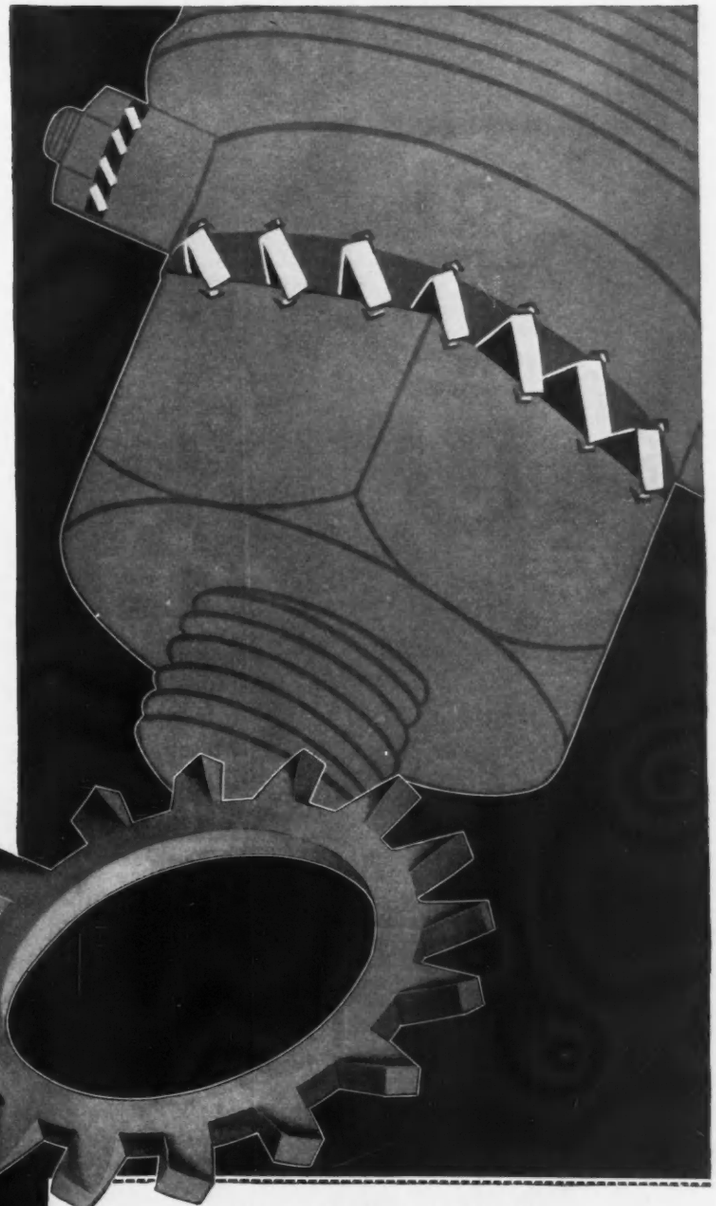
THE NEW-JERSEY ZINC CO.

160 FRONT STREET, NEW YORK CITY

Zinc Metals and Alloys - Rolled Zinc - Zinc Pigments - Sulphuric Acid - Spiegeleisen

Twisted-Biting Teeth of Steel

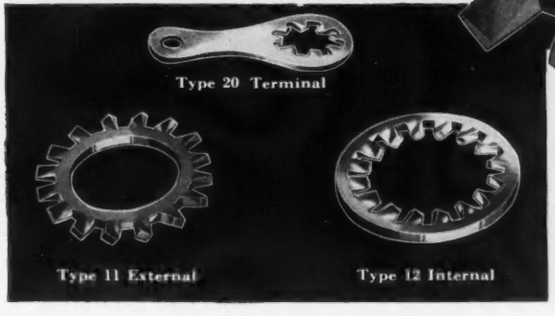
TIGHTEN the nut against the SHAKEPROOF Washer and it's there to stay. Gripped by twisted steel teeth, around the whole circumference, it can't loosen—applied pressure with a wrench alone can break its hold. SHAKEPROOF Lock Washers were developed for one purpose—to lock nuts. That they do this superlatively well is indicated by their universal adoption in over a hundred and fifty different American industries. Today SHAKEPROOF is the standard lock washer. It should be on your product. Let us send you samples to prove to yourself the merits of SHAKEPROOF.



SHAKEPROOF
Lock Washer Company
(Division of Illinois Tool Works)
2513 North Keeler Avenue Chicago, Illinois

SHAKEPROOF Washers are designed to meet any locking problem. Engineers are adapting the SHAKEPROOF principle direct to their problems and are assuring a better lock at a saving in operations. Submit your locking problems to SHAKEPROOF engineers for solution.

U. S. Patents 1,419,564; 1,604,122; 1,697,954. Other Patents Pending. Foreign Patents.



FREE SHOP TEST SAMPLES

SHAKEPROOF LOCK WASHER CO.
2513 North Keeler Ave., Chicago, Ill.
Please send me samples of

☐ Shakeproof Lock Washers to fit bolt size _____
☐ Shakeproof Locking Terminals, size _____
Firm Name _____
Address _____
Town _____ State _____
By _____

BOHNALITE
62%
Lighter than Iron

Production managers, factory managers, general managers, will find in Bohnalite the key to the solution of the problem of keeping weight in their product at the absolute minimum.

For Bohnalite is a new alloy 62% lighter than iron and rapidly taking the place of iron in many lines of manufacture.

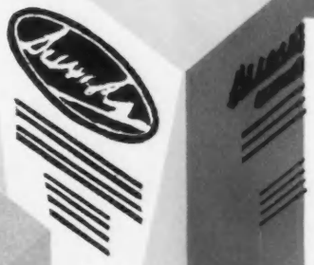
Possessing every valuable property of iron, Bohnalite has many superiorities of its own, including high uniform hardness—great density—fine grained structure—tremendous strength—excellent bearing qualities—ductility and lightness.

We would like to go into detail with your engineers on the marked advantages of Bohnalite.

Send us your blue prints and samples and let us show you how Bohnalite will increase the efficiency of your product. Ask for the new Bohnalite booklet.

BOHN ALUMINUM & BRASS CORP., DETROIT, MICH.
New York Chicago Philadelphia Cleveland Pittsburgh

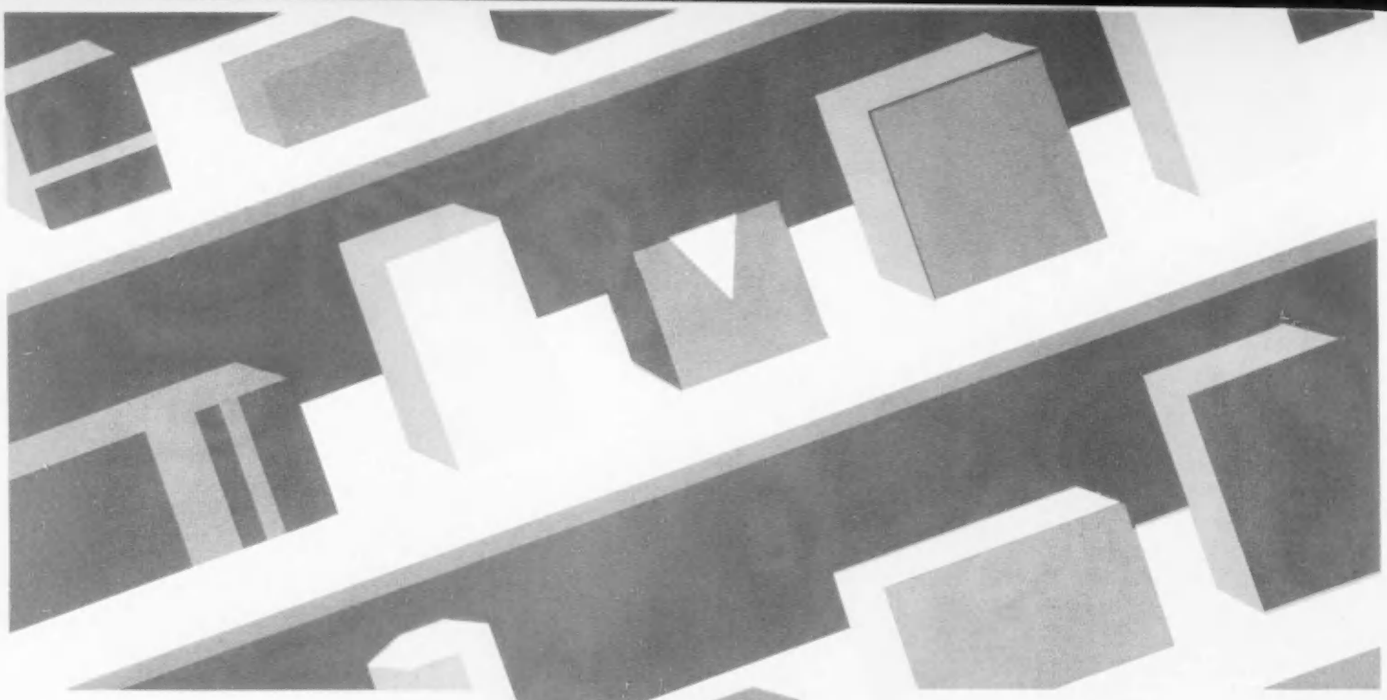
GAIR CARTONS



THE glint of the color-dotted silvery fish in the lush grass lightens your eye and the gleam of the spoon on the end of your line sends him plunging greedily for it. It simply cannot be helped—color is nature's excitant. In the surrounding stimulating maze of color, we do not miss the flash of a single hue. ▾ ▾ ▾ Gair Folding Cartons are printed or lithographed in outspoken colors that flow from the expert brushes of our carton artists. The Gair Creative and Design Department has prescribed Carton structure, design and color for the great merchandisers of the country. They are experienced in promoting a mental state favorable to Cartoned goods. ▾ ▾ ▾

ROBERT GAIR COMPANY

420 Lexington Ave., New York, N.Y.



Speed up Shelf Traffic

Folding Cartons personalize the merchandise they are built and designed to hold. They make the producer recognizable in the competitive jostle that goes on upon the retailers' shelves. The veteran Folding Carton may continue to be a symbol of reliability, but this is a capricious, irreverent age, in which modernity is preferred. ▾ ▾ ▾ Our Creative and Design Department is thoroughly practiced in modernizing or making what is supposed to be modern more effective without impairing the valuable, familiar features of your veteran Folding Carton. Feel free to consult these interesting experts. ▾ ▾ ▾ If you use cover boxes—write us. The "Gairco" Box is the pivot of a system. ▾ ▾ ▾

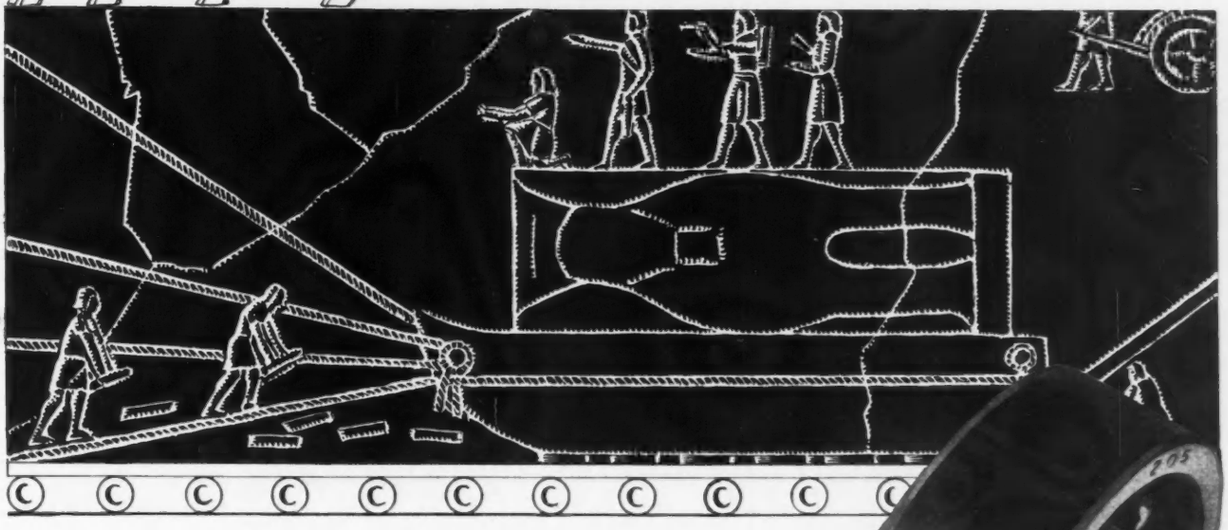
Always on the Green Light

We know the Production Manager's reaction to decorative art. His appreciation of color is as keen as anybody's but the universal scheme becomes red if the structure of the Folding Carton is such as to hold back his output. Gair Folding Cartons are popular in the Packing Room. Gair men thoroughly understand every automatic packing machine and its demands. ▾ ▾ ▾ The Gair Sales Department insists upon our pressing forward the information that the Thames River Corrugated Case Division, New London, Conn., flanked by the Warner & Childs Division at Boston, Mass., and the Interstate Division at Brooklyn, N.Y., have fifty-five Counsellors on design and structure in the field.

ROBERT • GAIR • COMPANY

420 LEXINGTON AVENUE, NEW YORK, N. Y.

The World FIGHTS FRICTION



The building of the Pyramids presented problems of friction which this early civilization overcame only slowly and laboriously. However, these methods did represent progress. Both the Egyptians and the Assyrians faced with the task of transporting huge blocks of stone for the erection of temples and palaces dropped a series of wooden skids on the ground, upon which lubricants had been poured. The stone moved over these skids, armies of unfortunate slaves furnishing the motive power. So the war against friction, successfully waged today with ball bearings, proceeded on its historical course.

POINTS where friction naturally develops are potential trouble makers. Be forehanded and install Torrington Ball Bearings at these vital spots.

Torrington Ball Bearings have established a clean cut reputation for reliability in overcoming friction... in operating at all times with the smooth ease characteristic of quality materials accurately manufactured. Torringtons are prestige-builders for far-seeing manufacturers.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

District Sales Representatives:

S. W. ANDERSON
565 W. Washington Blvd.
Chicago, Ill.

The TORRINGTON COMPANY
Curtis Building
2842 W. Grand Boulevard
Detroit, Mich.

The war against *man-made static* is on!

Manufacturers of electrical appliances and apparatus are enlisting their efforts toward the elimination of radio interference by *filterizing* their products ▲ ▲ ▲ ▲ ▲ ▲

THE vast army of radio enthusiasts is familiar with the interference in radio reception set up by a hundred and one types or kinds of electrical equipment, apparatus or appliances. They know the interference is there, ***but they don't know how to stop it!***

Thus, awakening to the fact that the interference ***can*** be stopped, the public is seeking relief through the channels of distribution of electrical commodities and appeals are coming in directly to the manufacturers. ***In seven states legislation is impending that will compel the suppression of this*** "man-made" static. Plan now!

TOBE Filterette

ELECTRO-THERAPEUTIC EQUIPMENT
DIRECT CURRENT ELEVATORS
MOTORS
BATTERY CHARGERS
BELL RINGERS
GENERATORS
REFRIGERATORS
ELECTRIC APPLIANCES
TOY TRAINS

ALL types of electrical equipment should be *filterized* — TOBE laboratories have perfected 36 types of FILTERETTES that *filterize* everything from a vacuum cleaner to a generator.

TOBE *filterizing* equipment goes into every nook and cranny of the land where electrical equipment is used—in the cities where electric appliances, elevators, hospital equipment, electric signs, etc., interfere with neighborhood radio reception; even into the suburban and country places where the apparently silent traffic beacon almost puts radio out of commission.

The electrical manufacturer can increase consumer acceptance of his product by equipping it with a TOBE FILTERETTE. It doesn't matter what the product may be, if it interferes with radio reception there is a TOBE FILTERETTE that will absolutely suppress such interference.

TOBE has pioneered in the elimination of radio interference of a thousand kinds—the experience thus gained is of great importance to electrical manufacturers who desire broader markets for their products.

Our engineers are always ready to cooperate.

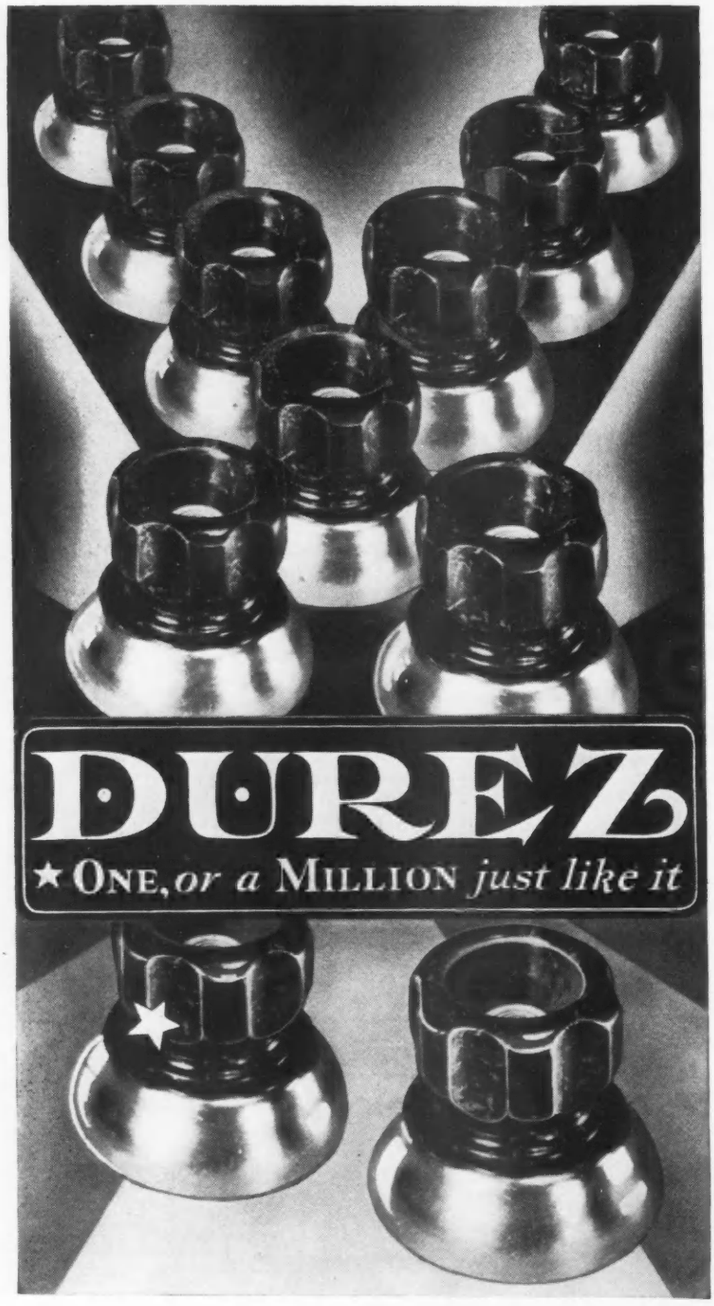
TOBE DEUTSCHMANN *Corporation,* Canton, Mass.

Filterette Division

This is the label that makes sure of the acceptance of your product by the purchaser who enjoys perfect radio reception. At the right are a few of the many types of FILTERETTES made by TOBE.

You can make it beautiful—economically!...

STEWART-WARNER *did it with* DUREZ



MANY a manufacturer looks at the popular demand for color with some alarm. "Suppose I do add color," he reasons. "How much is it going to increase my production costs? Will it affect the selling price? Does it mean a real advantage over competition?". . . Stewart-Warner has the answer, in this new *Pass-a-lite*. They use Durez—and get beauty and economy *both!*

The Pass-a-lite is an ingenious cigar-lighter for automobiles. And it is amazingly good-looking! The heating bowl—the Durez-molded part—comes in mottled red and black. Durez did that! Durez is available in all practical colors — colors that can be blended, mottled, pebbled or striated. But Durez did more! It made that part in one operation! It came from the mold finished. No burnishing, tooling or polishing was necessary.

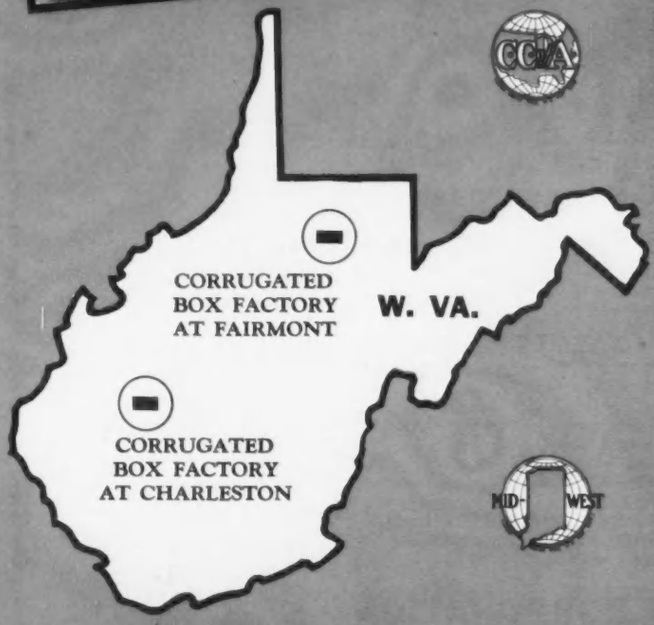
Durez fuses and hardens rapidly. Studs may be imbedded, holes made, prongs inserted during the molding process. But more than that. . . . The finished product is strong, hard, tough. It resists heat, acids, moisture, alkalines, gases. It will not corrode. It has high dielectric strength. Is it any wonder, with the production economies Durez affords, the added beauty it gives to the product, the efficiency it insures — that Durez is rapidly replacing wood, bronze, metal, glass, porcelain and other materials in many industries?

What are you making? Is it as beautiful as it can be—as it *should* be? Are you sure it can't be made better—with Durez? Let our engineering and laboratory staff co-operate with you on any experimental work or production problem. General Plastics, Inc., 79 Walck Road, North Tonawanda, N. Y. Also New York, Chicago, San Francisco, Los Angeles.

Write for this free booklet—"Do It With Durez." Contains complete information about Durez —physical and dielectric properties, color ranges, and scores of possible applications.

Right—Our corrugated box factory at Charleston, West Virginia.

Our corrugated box factory at Fairmont, W. Va., is shown at the left.



THE HOME OF DEPENDABLE CORRUGATED SHIPPING CONTAINERS

[Exhibit No. 4 of a Series]

CORRUGATED BOX FACTORIES

of the

CONTAINER CORPORATION OF AMERICA

and MID-WEST BOX COMPANY

in WEST VIRGINIA

OUR Corrugated Box factory at Fairmont, West Virginia, is another prominent unit of the Mid-West "Consistent Quality" group (since 1926 affiliated with the Container Corporation of America), known, wherever corrugated shipping containers are used, for general excellence. This plant serves West Virginia and Virginia, the Carolinas and bordering states.

The plant at Charleston, another Mid-West unit, also makes the superior grade corrugated with high, resilient corrugations so typical of the Mid-West product. It serves practically the same territory as Fairmont on the north, plus bordering Southern States.

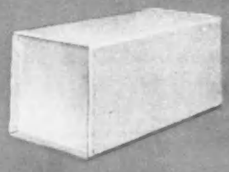
The location of these several plants insures first-class service and comparatively short hauls.

OTHER FACTORIES AND MILLS

at Philadelphia (Manayunk) Pa., Natick, Mass., and Bridgeport, Conn. (except Chicago, Anderson, Ind., Kokomo, Ind., Cleveland, O., Circleville, O. and Cincinnati, O., plants, previously shown in this series)

WILL BE FEATURED IN LATER INSERTS

A Great Variety of Goods — Fragile, Solid *and* Liquid Now Packed in Fibre Board Containers

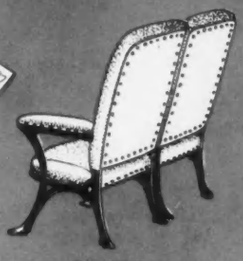


Pilferproof Recessed End Shipping Box

Matches

Shoes

Tobacco, Cigars Cigarettes



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Everything in Cans

Reshipping Case for Bottles and Bottled Goods

Toys — All Kinds

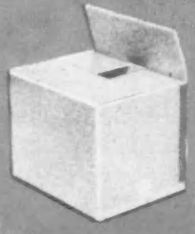
Lamp Wrappers

Electric Light Bulbs

Dry Cell Batteries

Soaps, Washing Powders and Flakes

Milk, Preserves, Etc.



Slotted Carton for all Commodities

Just a Word of Caution to Buyers of Fibre Boxes

WHEN lower prices obtain on corrugated products we have noted a tendency on the part of some manufacturers to "experiment" in the quality of boxes specified in orders. Although railroads specify that liners in corrugated boxes shall caliper .016 or more and shall have a bursting strength per square inch of 85 lbs., or higher, and 175 lbs. per square inch bursting strength, or higher, in solid fibre boxes, yet, in some instances boxes are furnished which do not meet the required tests. Buy from reliable makers that do NOT experiment.

Let us help solve your shipping problems with highest quality boxes. Send in COUPON below.

Some Industries Now Using Our Solid Fibre or Corrugated Boxes

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Canners
Building Material
Sporting Goods
Books and Magazines
Toys
Crockery
Bottlers
Fruit Packing
Radio Goods
Pictures
Vegetable Growers
Meat Packing
Dairy Goods
Soaps and Chips and Washing Powders
Matches
Furniture
Stationery
Lamps and Shades
Tobacco—all forms
Perfumery
Paints and Varnishes
Automotive
Glassware
Insecticides
Rubber Goods
Electrical Goods
Men's, Women's and Children's Furnishings
Millinery
Confectionery
Carpets and Rugs
Shoes
Breakfast Foods
Proprietary Remedies
Spices
Foods—All Kinds
Instruments
Brooms, Brushes, Etc.
Ceramics
Leather Goods
Doors
Hardware
Dry Cell Batteries
Enamelware
Filing Cabinets
Electric Light Bulbs

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111 W. Washington Street Chicago, Illinois

Six Mills—Twelve Factories—Capacity over 1200 tons per day

RETURN COUPON

CONTAINER CORPORATION OF AMERICA
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Gentlemen: Please have one of your experts check our present packing and shipping methods—without obligating us—for the purpose of reducing our costs if possible.

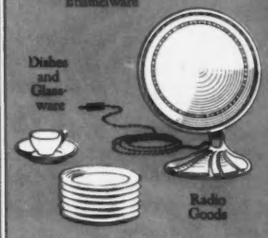
Name_____

Title_____

Firm_____

Address_____

Pottery and Enamelware

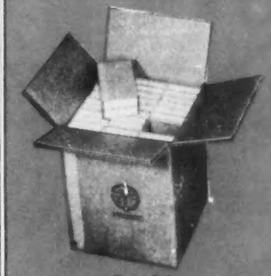


Dishes and Glassware

Radio Goods

Electrical Goods

Reflectors

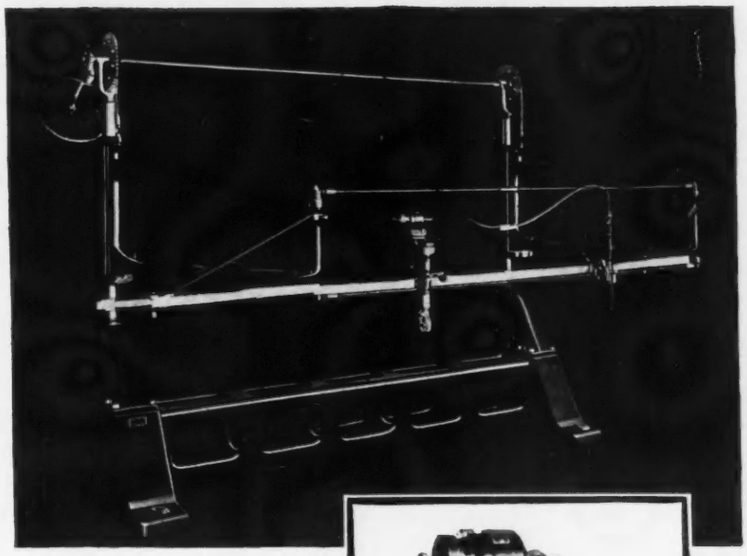


Enameled Tile

Wherever goods are manufactured — there you will find our boxes reducing packing and shipping costs.

Cutting Steel in irregular shapes

Another Dumore Service



DUMORE MOTORS power a wide range of devices. Their assignments are varied. An interesting and particularly unusual one is that of helping to *cut steel in irregular shapes* by being used on the tracer. No metal is tougher ... no service more exacting ... yet Dumore Motors do this work with the same dependability that makes them outstanding in other fields.

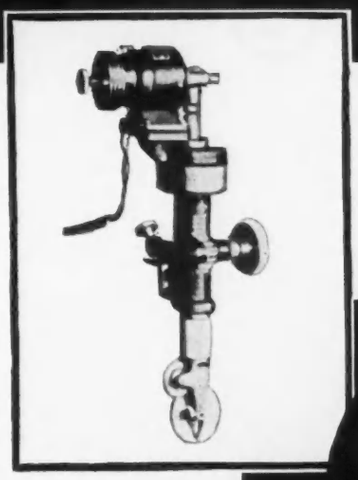
All Dumore Fractional Horsepower Motors are made to give unfailing power. They are built first to assure *dependable service* ... secondly, to keep active longer ... third, to meet the *speed* and *load* of each job. Over a period of a quarter of a century Dumore Motors have been known for exactly that.

This is but one of the interesting fields served by Dumore Motors. For full details, and how efficiently Dumore Motors will work when applied to your product, write our Engineering Research Department.

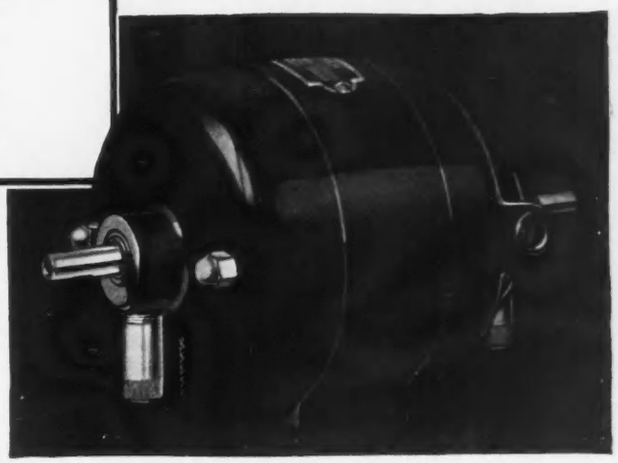
THE DUMORE COMPANY
35 Sixteenth Street Racine, Wisconsin

DUMORE MOTORS are used in

Electric Vacuum Cleaners
Electric Floor Polishers
Sewing Machines
Oil Burners
Grinders
Drills
Drink Mixers
Dental Engines

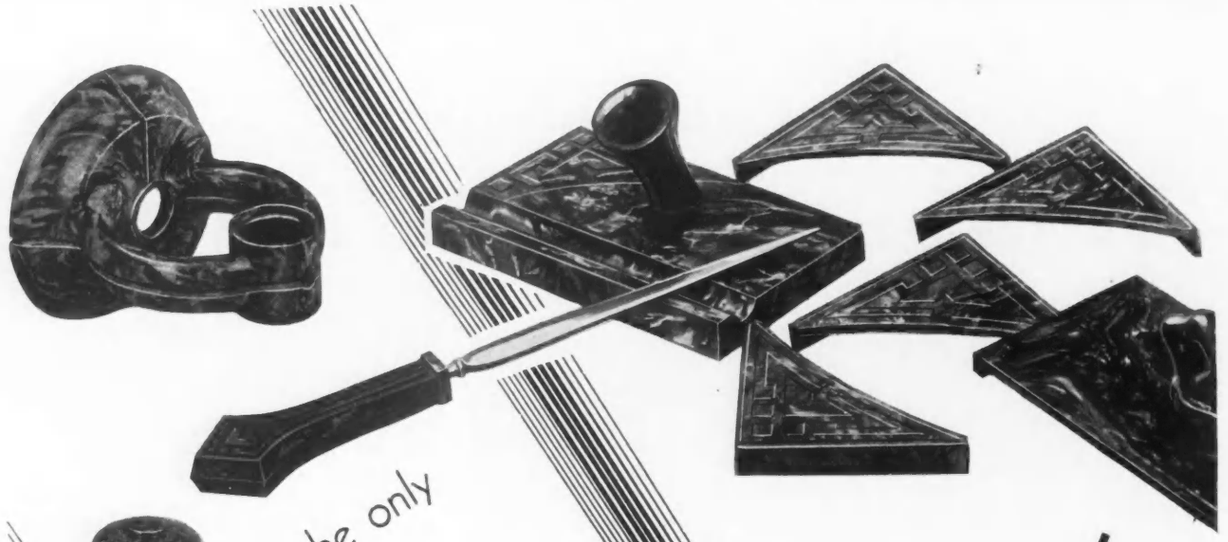


A Dumore Fractional Horsepower Motor is used on the tracer of this Oxyacetylene Cutting Torch. This machine is used for cutting both straight lines and irregular shapes in rolled steel, forgings, etc.



TRADE MARK
DUMORE
REG. U.S. PAT. OFFICE

FRACTIONAL HORSE POWER MOTORS ARE DYNAMICALLY BALANCED!



—the only molding material that provides for the limitless use of COLOR

COLOR Is King!—ruling over a domain ablaze with flashing reds and crimsons, or steeped in the intriguing tints of a rare sunset.

COLOR is now demanded in everything, from kodaks to kitchen aids.

Thousands of molded things that were lifeless through lack of color may now be made in any tint of the color spectrum—in LUMARITH.

LUMARITH is a molding material that is virtually non-inflammable; it will not peel, chip or crack; it never loses its lustrous, appealing beauty; it can be molded in any shape possible in the diemaker's art.

Natural color illustrations will be sent upon receipt of your request. These illustrations show amazing possibilities for attaining any desired blend or mottle in colors and pearl effects.

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LUMARITH

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The locations of Hinde & Dauch board mills, box factories and branch offices have been definitely selected to bring H & D package engineering service as near *your* business as possible.

Get in touch with the nearest H & D office whenever you have a shipping box problem to solve. You'll find that the 50 H & D package engineers have a vast fund of experience in packaging problems to place at your disposal.

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A telephone call, telegram or letter to the nearest H & D unit will start the world's greatest packaging organization working for you at once.

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Cuyahoga Falls	Cuyahoga 268M
Dayton	Main 223
Detroit	Glendale 4947
Grand Rapids	31439
Indianapolis	Riley 1188
Kansas City	Victor 5532
Louisville	City 644
Minneapolis	Atlantic 1833
Muncie	Main 2286
New York	Worth 1684
Peoria	45069
Philadelphia	Lombard 7381
Pittsburgh	Grant 6187
Richmond	Randolph 604
Rochester	Culver 2177
Sandusky	Main 304
South Bend	Main 3-1101
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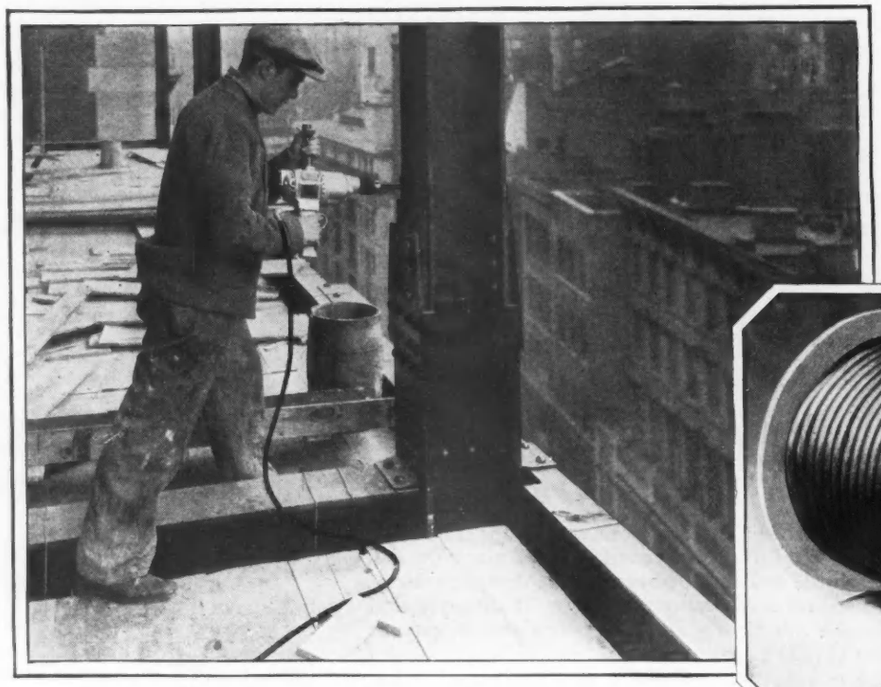
"Engineered Packages in the Electrical Industry" describes the many advantages of H & D corrugated fibre shipping boxes and the complete service of the world's largest packaging organization. Mail the coupon for a free copy.

THE HINDE & DAUCH PAPER CO., 325 Decatur St., Sandusky, Ohio
Please send a copy of "Engineered Packages in The Electrical Industry."
Name.....
Address.....
Town..... State.....
We are interested in packing.....



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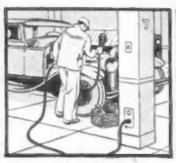

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Right on the job . . . all day long—*that's* what makes electric tools maintain the good name of their manufacturer . . . bring repeat business. GE-Flex All-Rubber Cord helps keep them working . . . builds *your* sales.

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Electrical Manufacturing

Production - Marketing - Administration - Repairing

Volume 4 AUGUST - 1929 Number 2

Standardization Aids the Electrical Industry

L. L. Elden

In the electrical industry, where much has already been accomplished in standardization work, there still remains more that can be done in the way of developing standards in ratings, switching apparatus, distribution systems, appliance performance, motor rules and other phases of the industry

By L. L. Elden

*Boston Edison Electric Illuminating Company**

STANDARDIZATION is not new in industry although the intensive efforts of recent years are indicative of new interest in this work. Competition for industrial and commercial supremacy has forced a new order of things, in that production and marketing methods have been developed on a scale hitherto unapproached in business life. In most standardization work it is difficult to distinguish between simplification and standardization, yet in the end, it is a combination of both, coupled with methods for eliminating waste, that prove to be fundamental factors underlying the success of most undertakings. Many standards are temporary and subject to change to conform with progress in any art or industry. To accept as final any given development would be fatal to national progress. Research and invention will ever continue to develop new materials and processes, which in their commercial applications will displace many existing standards in favor of newer methods.

Under the present high pressure urge to extend standardization to include every possible activity, material progress is being made toward the desired end. Through the cooperative efforts of international and national organizations, societies, corporations, and individuals, standardization is being continuously extended into new fields of endeavor with results which must in the end favor the ultimate consumer.

Governmental and other agencies have largely standardized almost everything that comprises the home, including the materials used in its construction, the clothing we wear, and the food we consume. Even the humble cow must provide milk conforming to prescribed standards or she is taboo. Examples of both existing and obsolete standards might be multiplied indefinitely without further effect, other than to present more evidence of tangible results which have already been accomplished in work of this character.

Turning to the present we find in the telephone industry the most highly standardized undertaking in the electric utility field anywhere in the world. This status has been reached by successive steps, only, as the result of intensive research and experimentation by a highly trained organization, without which the present-day perfection of communication facilities could never have been attained.

Lack of standards during the first thirty years of the electric light industry was undoubtedly responsible for

* Abstracted from an address delivered before the Engineering Session of the fifty-second annual convention of the National Electric Light Association at Atlantic City, N. J., June 3-7, 1929.

serious losses in many directions. This situation was but the natural outcome of independent development of systems and apparatus in a new industry. The combination of numerous frequencies and voltages, direct and alternating currents, series and multiple systems, and overhead and underground distribution methods were handicaps which would have destroyed almost any other new industry. In this case the worldwide desire for better illumination provided the necessary incentive to continue development work in the hope of ultimate reward.

¶ The combination of various voltages and frequencies, series and multiple systems, etc., were enough to have destroyed almost any new industry

MOST of these troubles are now behind us. The adoption of sixty cycles as a national standard, supplemented by twenty-five cycles for special applications, solved the frequency question and paved the way for the development of systems and standardized equipment on a scale even now unapproached elsewhere in the world. Concentration upon a minimum number of types of systems for generation, transmission and distribution, and the elimination of the many odd and special voltages utilized in early practice, have been contributing factors to present success.

The designs of generators, converting and switching apparatus, and overhead and underground construction have also been more or less standardized at intervals in recent years, although such standards have been subject to frequent changes to keep pace with a rapidly changing industry. Insistence on special designs and failure to adhere to the use of existing standard apparatus have materially retarded efforts toward standardization in many directions.

¶ Twenty-five years of intensive effort in the development of recording watt-meters have produced the present simplified and standardized product

The present-day incandescent lamp is perhaps one of the best known examples of accomplishment through standardization. Progress in this work from the days of the carbon lamp has been reflected, in so far as public interest is concerned in a steady improvement in efficiency accompanied by heavy reductions in selling prices. Efficiencies of one-half to one watt for modern lamps may be compared with five and six watts or more per candle for early carbon lamps. Selling prices have been reduced 53 per cent since 1914 and 50 per cent since 1920. Two 40-watt lamps may now be purchased for the price of one in 1920. Important factors in this accomplishment included the adoption of the Edison screw base as a national standard for lamps, sockets, and fuses. A single standard base thus replaced twenty-six types of bases. Standardization of lamp voltages within a range of 100 to 130 volts in 1914 reduced the number in common use from twenty to five. Similar action in 1924 further reduced this number to three.

A new standard line of internally frosted lamps, comprising five or six units, introduced in 1925, replaced forty-five individually different types of lamps then in general use. Concentration of demand on a few types and sizes, the extensive use of automatic machinery, and the introduction of mass production methods have in this instance, as in many other lines of business, effected large reductions in the cost of the manufactured product.

Twenty-five years of intensive effort in the development of recording watt-meters have produced the present simplified and standardized product. This work has involved the closest cooperation between manufacturers and utility interests in order that meters might be produced which would be accepted as countrywide standards for general use. This policy is in direct contrast with foreign practice where it has been customary for different countries and even individual companies to require meters of special designs.

Meter performance has been so improved that a high degree of accuracy is maintained under overloads of three to four hundred per cent. Temperature compensation is so perfect that the effects of high and low ambient temperatures at meter locations may be disregarded. Meter overload capacities for short time loads have been substantially doubled. Potential coil losses in the most used sizes of meters have been reduced from two and one-half to one watt. In a large system with one million meters such a reduction is equivalent to a reduction of 1500 kw. in the generating capacity required to energize the meters, and over 13,000,000 kw-hr. in the non-productive output of the system. In the face of enormous development costs, the average selling price of A. C. meters has been reduced from $11 to $9. On an annual production of 1,500,000 meters, the saving to purchasers of this single commodity reaches $3,000,000.

Distribution transformers have undergone many drastic changes in design before reaching their present-day perfection. To effect desired standardization and meet changing operating requirements, air-cooled transformers have been largely superseded by oil-cooled types, sheet steel has replaced cast-iron cases in many sizes, special steels have been developed for core structures and many electrical and mechanical features introduced to improve transformer product as a whole. New insulating materials have replaced inferior types, some of which were unsuited for use in conjunction with modern insulating oils. Electrical and operating characteristics have been steadily improved until the present-day transformer leaves little to be desired in these respects. Standardization of performance characteristics and tap connections to conform with recently approved voltage standards appear to be all that is required to complete the standardization of this product. Voltage standardization has been an important factor in transformer development through making possible substantial reductions in the number of sizes and types of transformers regularly manufactured. Through the joint action of N. E. L. A. and Nema interests in 1924 in agreeing upon a schedule of standard voltages, a reduction of 50 per cent in the number and sizes of ratings was effected. For this greatly improved product, selling prices have been steadily reduced to about 42 per cent of 1896 prices and are now only about 7 per cent higher than 1914 costs in the face of higher general costs now prevailing which exceed 1914 costs by 46 per cent for raw materials, 0.72 per cent for living costs, and 140 per cent for cost of transformer labor.

¶ Voltage standardization has been an important factor in transformer development by making possible reduced number of sizes and types

MOTOR standardization has long been required for economic reasons. Recent progress in this direction has fully justified the extended efforts which were required to secure general agreement upon satisfactory performance characteristics and rating methods controlling the design of the great bulk of motor production. Settlement of the long-standing controversy between advocates of 40 degree versus 50 degree bases of rating, by the adoption of a single standard of 40 degrees plus a service factor, as the future basis of motor rating paved the way for general standardization. Selling prices of motors now reflect in part the results of this work, for example, three one-horsepower

general purpose motors cost slightly less than one similar motor in 1902. Another example is the well-known one-quarter horsepower washing machine motor costing $25 in 1921, which now sells for $9.50.

Manufacturers have recently concentrated their efforts upon a simplification program directed at standardization of motor parts and dimensions. In a single step one manufacturer reduced the number of bearing sleeves required for its product one-half and in a final adjustment now requires but fourteen sizes for thousands of motor ratings. All such developments make for volume production with favorable effect upon the entire product even though the output of certain individual units contributes little to the output as a whole.

The rating of electrical machinery is one of the most important problems before the industry. Failure to adopt methods of rating which will insure the maximum possible output for a given investment results in an economic loss to all concerned. Temperature being for the most part the limiting factor in the performance of all electrical apparatus, standards have long been established, indicating the maximum temperature at which various types of insulation may be safely operated, as determined by standardized methods of temperature measurement. These standards while primarily designed to be utilized for test and guarantee purposes, have also been regularly employed to control the loading of apparatus in service to the disregard of existing temperature conditions favorable to securing greater output.

Under pressure of utility engineers, previously existing standards have been modified to provide supplementary ratings for apparatus under "service conditions." Recognition of this principle, as already applied to general purpose motors and transformers, permits an increase in the rating of these specific classes of apparatus, ranging from fifteen per cent upward under prescribed temperature conditions. The inclusion of "service ratings" in all rating standards based upon limiting temperatures, should engage the attention of all standard-making interests, pending the time when rating standards based upon maximum temperatures may be properly substituted for prevailing methods.

¶ The establishment of voltage standards has been of paramount importance to the industry in its effect on lamp and appliance production

The establishment of voltage standards has been of paramount importance to every branch of the electrical industry. Even the earlier indecisive efforts in this connection were important in their effect on lamp production and the development of appliances and much of the vast array of apparatus now in general use. Concentrated efforts on this general problem have finally resulted in an agreement upon a new basis for voltage standardization which recognizes for the first time in the history of the industry the various steps in voltage regulation from power-house to the customer which are necessarily encountered in actual practice.

¶ Standards may be nothing to enthuse over; yet there is considerable satisfaction in accomplishments that have aided manufacturers and consumers alike

THESE standards as now constructed are primarily based upon delivered voltages and, therefore, include specifications for primary and secondary transmission and distribution voltages with the necessary tap connections required under standard operating procedure. Under this program we may anticipate rapid concentration upon the use of not more than two lamp voltages under conditions which will react favorably upon the design and operation of a multitude of miscellaneous appliances and kindred apparatus.

International standardization of voltages appears impossible at the moment, largely due to long-standing differences in national practices which now preclude wholesale changes in construction and operating procedure to secure international agreement on this question.

¶ Selling prices of motors now reflect the results of standardization work, since three one-horsepower motors cost less than one did in 1902

FURTHER examples of electrical standards which have been developed to overcome obvious defects in equipment and system operation, incident to the prevailing large scale developments of the industry, would include many individual undertakings of this character. Cable insulations have undergone complete revision, insulators for high tension service have been redesigned, switch performance and design have been improved, and insulating oils for transformers and switches have been reduced to a common standard which is approved for general use in a vast amount of equipment within prescribed voltage limits. Various organizations working in special fields have created standards which have assumed national importance. Prominent in this field is the Board of Fire Underwriters, whose work in developing standards for wiring and wiring equipment is well known to all. To those who are familiar with efforts of this character it will be evident that such a list could be expanded indefinitely to cover actual accomplishments.

Standardization to be effective naturally requires the closest cooperation between affected interests and in this respect utility interests may be well satisfied with their participation in this work. From the very nature of their position it has been necessary to evaluate the merits of almost every new piece of apparatus by actual trial on their respective systems. While their contributions have been large through personal effort, and absorption of the cost of development and experimental work in the cost of apparatus, it has only been through actual use under service conditions that the merit of most equipment has been demonstrated. From this "cut and try" experience numerous constructive suggestions have been advanced by utility engineers and it has been their continuing spirit of cooperation and compromise that has led to the approval of those acceptable standards which are controlling factors in the advancement of the industry. So far attention has been directed to certain examples of standards which affect quality, performance, and finally the cost factors of products in their particular fields.

There remains a vast array of miscellaneous standards which deal with processes, dimensions, materials, and construction, or take the form of specifications, rules, regulations, and codes. Each has its appropriate application, but whether its existence is justified or not depends largely upon the economic advantages derived from its use. We may view many standards with unmixed satisfaction, knowing their effectiveness in application, while others less productive of good results may be appraised upon a less favorable basis. In the matter of safety codes designed to reduce life and property hazards, no one will dispute the desirability of such guidance, yet the inclusion of mandatory provisions governing construction details may require excessive investment far outweighing any possible advantage secured through their use. Failure to control the personal equation has been a fatal weakness in all safety code regulations. On the other hand regulations

(*Continued on page 70*)

A Manufacturer's Suggestions for

Designing Springs

The following is the first article of a series in which a manufacturer points out just what information is most essential in the designing and buying of springs

By L. D. GRANGER
Wickwire Spencer Steel Company

IN any piece of apparatus the spring may appear a very insignificant part of the mechanism, and it may seem that almost any kind of a wire bent or coiled would do the work, but it only requires a circuit breaker to stick or a failure of a lamp to light, to convince us how important these little things are, and how useless the rest of the mechanism is without them.

Springs hold down brushes on commutators, make circuit breakers operate at the proper point, enable us to measure correctly electrical loads, complete telephone circuits, and in many other ways make possible the commercial utilization of electricity for power, light, speech, and radio.

It is evident, then, that a spring though insignificant is yet a very dignified object, and that the methods of first designing it, and second of avoiding some of the many pitfalls in the path, are worthy of study and attention in this series of articles.

Let us first see just what a spring is from a mechanical point of view. In our studies of materials of construction as, for instance, in the design of a skyscraper, or a bridge, or an automobile, we estimate just what stress will be encountered in a chord, how much compression or tension a beam must support, or how much torque a shaft must sustain. We apply formulas, obtain the proper area of section, multiply it by two, or perhaps three or four, so as to be safe, and feel that the resulting design will hold all the load liable to be put upon it without failure. It makes little difference—except from a cost standpoint. Perhaps if we do use a pound or a ton more material than is absolutely necessary, the bridge will not fall, and the building will not sway too far in a gale. Here immobility and inflexibility, comparatively, are our end.

With a spring, however, we want motion—not only motion, but usually a pretty definite amount, and within rather

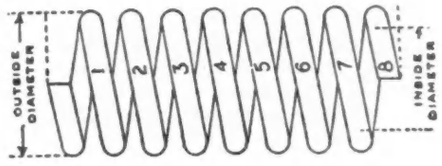


Figure 1

This and the other illustrations on this page show four of the different types of compression springs now in general use. That above has eight coils with plain ends, not ground

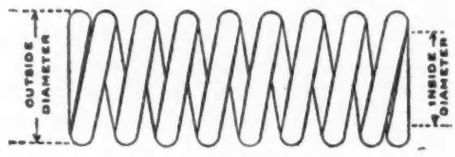


Figure 3

Another type of compression spring. It has nine and one-half coils with its ends squared and ground. In all springs either inside or outside diameters are specified

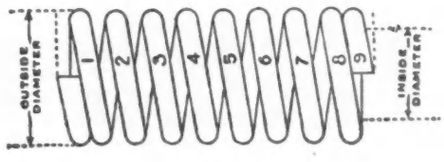


Figure 2

Another type of coil spring designed with nine coils and plain ends that are squared but not ground. In such springs as these the direction of winding is not highly important

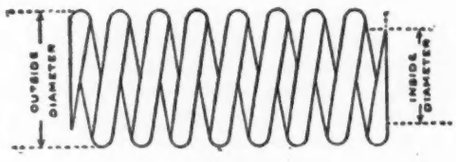


Figure 4

This spring is similar to that in Figure 1. *It has eight and one-half coils with the ends ground. Grinding the ends provides square surfaces for the support of the spring*

narrow limits for quantity. A beam or a girder must carry a definite load with a negligible deformation or movement. A spring must carry a definite load with a definite movement, and must do it again and again without weakening or breaking. So it is no wonder that so much study and time have been expended upon finding out how to do it.

In general, we have five types of springs:

Extension
Compression
Torsion
Flat
Motor or Clock.

We will take these up in order:

Extension springs are usually close wound and may or may not have an "initial tension." By this we mean that, by giving the wire a certain backlash when coiling, the coils are not only in contact, but that some considerable pull is required before they will even separate. The amount of pull that a spring so coiled requires before the coils separate is called the initial tension. This feature is of great value when a comparatively high load is required with a short travel, and space limitations are important. A "limber" spring, with no initial tension, extends uniformly with the first load, and the coils separate immediately. The extension curves for such springs would appear as shown in Figure 6.

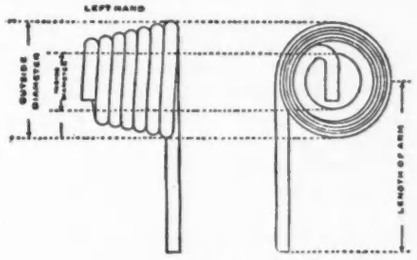


Figure 5

Above is one form of torsion spring in the design of whch it is necessary to specify for the manufacturer the number of coils, direction of winding, diameter, and length of arm

The two curves are parallel in the straight portion as both springs, if of the same design, will hold the same "scale"—or pounds per inch of travel—but one requires the initial load to separate the coils. Note also that the final safe load for each spring is the same, as this is determined by the allowable stress in the wire. If some of this is taken up before the coils open there is of course not so much available for further extension.

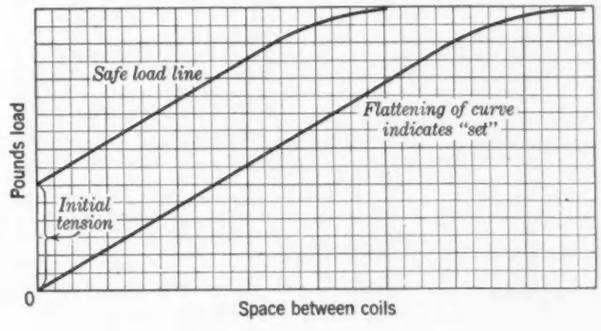


Figure 6

In extension springs there are times when "set" may take place and the spring may not return to its original form. This condition is clearly shown by the load curve deviation above

It is a difficult thing to calculate initial stress, and probably no two springs have the same amount except by accident. In general approximately 5 to 15 per cent of the total load may be used as initial.

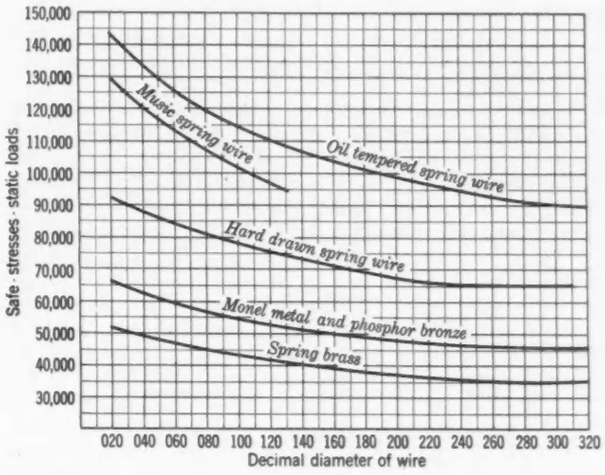


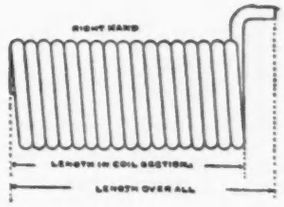
Figure 7

This chart shows clearly the tensile and elastic limits as covering a range varying with the wire size. Approximate values for safe fibre stresses for different materials are shown

In the case of extension springs there is no automatic limit to the amount of extension that a spring can be given, the design is not "safe" and at times through over extension, "set" may take place, and the spring may not return to its original condition. This condition is shown by the deviation of the load curve from a straight line in Figure 6.

Figure 8

This is still another type of torsion spring in which it is essential that the manufacturer know the direction of winding, the number of coils, diameter of wire and diameter of spring



In a compression spring, the movement is in the opposite direction. The coils are open in the normal or free position, and when the load is applied, the coils come nearer together until finally, when the spring is "solid," they touch. Thus the maximum movement is definite, and a properly designed spring should work any number of times up to full compression, if required, without failure through either setting or breakage.

When the loads or movements required are not in a straight line, as with compression or extension springs, but are in a circular or radial direction, torsion springs may be required. The applications are so many and so difficult to describe that it is much easier to picture a few of them. The load specifications for extension and compression springs are usually so many pounds at such a height, or with so many inches movement. Torsion springs, however, are usually specified to carry a certain number of inch-pounds, or a definite load at a given radius from the center. They may be close coiled or open coiled, and are usually provided with special ends adapted to fit the

mechanism they operate. Three fundamental conditions are necessary to consider in their design:

1. The spring should always be loaded in the direction which would wind it up. Therefore, it is necessary to specify right hand or left hand winding, or clockwise or counter clockwise, as is sometimes specified.

2. As each revolution will add one wire diameter to the length of the spring as it is wound up, space must be left for this elongation.

3. As the inside diameter decreases when the spring is wound up, care must be taken to prevent binding on a shaft or rod on which the spring may work.

Flat springs are of many and varied types. To this class belong the leaf springs of the automobile, and the vibrator of the spark coil. Fuse clips are really specially formed flat

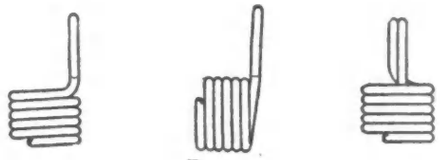


Figure 9

Above are three different types of ends for extension springs. The manufacturer, in making such springs as these, must know the direction of winding, diameter of wire and diameter of spring

springs, and the contacts in the shell of the electric light socket depend upon the springiness of the flat strips for their operation. Tempered steel, or hard rolled phosphor bronze, may be used as materials.

Clock or motor springs are familiar to users of phonographs and recording meters, particularly. High-grade tempered flat steel forms the base for their manufacture, and upon the proper combination of width, thickness, and length depends the power of the spring and the length of time it will operate the mechanism. The hair springs in

Figure 10

These are the same ends as shown in Figure 9, illustrating the manner in which the loops or ends are formed. In each case the size of the opening or loop must be specified

meters are of this general type, although of a very highly specialized design.

The materials generally available for spring manufacture are as follows:

Table I—Spring Materials

Material	Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Modulus Tension Million	Modulus Torsion Pounds
Bessemer steel	90,000 to 120,000	50,000 to 65,000	29 to 32	9 to 10.5
Hard drawn spring wire	180,000 to 220,000	95,000 to 115,000	29 to 32	9 to 10.5
Oil tempered wire	180,000 to 280,000	135,000 to 200,000	29 to 32	9 to 10.5
Music wire	290,000 to 400,000	150,000 to 220,000	29 to 32	9.5 to 10.5
Monel metal	90,000 to 120,000	40,000 to 60,000	29 to 32	8
Phosphor bronze	90,000 to 120,000	40,000 to 60,000	15	6
Spring brass	70,000 to 90,000	35,000 to 45,000	10 to 12	4.5

The tensile and elastic limits are shown as covering a range varying with the wire size. Approximate values for maximum safe fiber stresses for various materials are shown in Figure 7.

The elastic limit—that load which the wire can hold without permanent deformation—may be taken as 50 to 55 per cent of all the grades of wire except oil tempered, in which case it runs about 75 per cent of the tensile. The elastic limit, of course, is the figure with which the spring manufacturer has to work.

The higher grades of wire are used when proportionately heavy loads are to be carried. The value of phosphor bronze or brass wires are their resistance to corrosion which, in electrical equipment is often of the highest importance, and justifies the extra expense involved. Steel wire springs may be plated with zinc for the less severe conditions. It is always dangerous, however, to plate or in any way to expose tempered wire to acids, as an inherent brittle condition is produced which may be evident by breakage even after a considerable period of time.

Having, then, decided from all our conditions the type of material desired, we start to determine the physical characteristics of the application.

The most important point in spring design is the stress at which it may be considered allowable for the spring to operate. This varies with the work which the spring is called upon to do. If the load is static—that is, if the spring is to maintain a more or less steady load, as in the case of a circuit breaker, and operate only occasionally, it is possible to use effectively nearly the full value of the safe fiber stress. If, however, the load is dynamic, and the spring operates continuously as in a gas engine valve spring, only a small portion—about 40 per cent—of the safe limit should be used as the working stress. It has been shown by many tests that a wire has an endurance limit and that if repeatedly operated at a stress above this limit, breakage through fatigue will occur. This limit varies with different grades of material, but 40 per cent of the safe maximum limit may be taken roughly as safe for extreme conditions. Considerable judgment may be used as to the allowable stresses to be used for the "in between" conditions.

Having determined the allowable stress, it then is possible

Table II—Spring Formulae

	Round	Square	Rectangular
1) P	$\frac{\pi S d^3}{8 D}$	$\frac{\sqrt{2} S d^3}{3 D}$	$\frac{S b t \sqrt{b^2+t^2} S}{3 D}$
2) P	$\frac{G f d^4}{8 D^3}$	$\frac{G f d^4}{1.5 \pi D^3}$	$\frac{G f b t (b^2+t^2)}{3 \pi D^3}$
3) f	$\frac{\pi S D^2}{G d}$	$\frac{\pi S D^2}{\sqrt{2} G d}$	$\frac{3 \pi P D^3}{b t G (b^2+t^2)}$
4) f	$\frac{8 P D^3}{G d^4}$	$\frac{1.5 \pi D^3 P}{G d^4}$	$\frac{\pi D^3 S}{\sqrt{b^2+t^2} G}$
5) S	$\frac{8 P D}{\pi d^3}$	$\frac{3 P D}{\sqrt{2} d^3}$	$\frac{3 PD}{b t \sqrt{b^2+t^2}}$
6) S	$\frac{f G d}{\pi D^2}$	$\frac{\sqrt{2} f G d}{\pi D^2}$	$\frac{f G \sqrt{b^2+t^2}}{\pi D^2}$
7) d	$\frac{\pi D^2 S}{G f}$	$\sqrt[3]{\frac{\pi D^2 S}{\sqrt{2} f G}}$	
8) d	$\sqrt[3]{\frac{8 P D}{\pi S}}$	$\sqrt[3]{\frac{3 P D}{\sqrt{2} S}}$	
9) W	$\frac{G d^4}{8 D^3 N}$	$\frac{G d^4}{1.5 \pi D^3 N}$	$\frac{G b t (b^2+t^2)}{3 \pi D^3 N}$

S = Stress. G = Torsional modulus of elasticity. f = Deflection per coil.
W = Pounds per inch deflection. N = Number of active coils.
D = mean diameter of spring. b = Width of rectangular wire.
t = Thickness of rectangular wire. d = Diameter of wire. P = Load carried

In the table above is a complete set of formulæ for round, square and rectangular sections, which will provide methods for calculating designs under almost any conditions

to make our first calculation for wire size. To do this we use a formula:

$$(1)\quad d = \sqrt[3]{\frac{8\ P\ D}{\pi\ S}}$$

where P = load to be carried
where S = allowable stress
where D = mean diameter of helix
where d = diameter of wire

To digress a little here, we wish to call to the designer's attention one point which may save him and the spring manufacturer some trouble. It is impossible to make a spring with a mean diameter of less than three times the diameter of the wire, and four times is much easier as a coiling proposition. So, do not design all of the rest of the equipment first and leave only a limited space for the spring. We have seen cases in which this was done and the cost of the spring was greatly increased through difficulty in manufacture. Determine the approximate size of the spring early in the design, and allow as generous a space for it as possible.

Formula for Spring Deflection

HAVING determined the size of wire by Formula 1, our next interest is in the deflection or movement necessary to hold the specified load:

$$(2)\quad f = \frac{8\ P\ D^3}{G\ d^4}$$

in which f = deflection *per coil*
in which P = load to be carried
in which D = mean diameter of coil
in which G = torsional modulus of elasticity
in which d = diameter of wire

After solving this formula by using the same values for P, D, and d as in Formula 1, and using the proper value for the torsional modulus of elasticity for the material, (the relative amount it will move for a given strain) we have the number of inches each coil of the spring will expand or contract under the desired load. By dividing

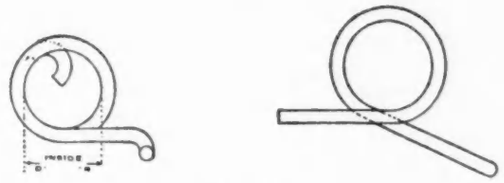


Figure 11

Here again are two distinctly different types of torsion springs in which it can be seen how necessary it is that the manufacturer be supplied with the most detailed data

the desired total movement by this amount, we have the number of coils necessary, as:

$$(3)\quad N = \frac{F}{f}$$

N = number of active coils
F = total deflection
f = deflection per coil

Then, by adding the number of inactive coils for squared and ground ends, or otherwise as described later, the design of the spring is complete.

These formulae work equally well with extension as with compression springs. The difference is mainly in the value of the allowable stress, as extension springs, as before stated, do not have an automatic limitation of stress and, in order to avoid trouble if over extension is possible, the value should be kept comparatively low.

Table 2 gives a complete set of formulae for round, square and rectangular sections, and will provide methods for calculating designs under any conditions. The rectangular formulae are approximate, and cannot be checked

Figure 12

As is clearly evident in such designs as this, the manufacturer must know the direction of winding of both halves of the spring, the diameter of the wire, diameter of the spring, number of coils and the lengths of the two extending arms. When there is a space between the coils, this must also be specified

in manufacture as closely as the round and square section.

Round wire is, of course, used wherever possible, on account of economy. Square wire may be resorted to on account of space limitation, as it will hold about 20 per cent more load than round wire of the same diameter. Rectangular wire presents a very interesting set of conditions as the relations between load and deflection may be made to vary widely by changing the dimensions of the wire.

Wire Sizes Affect Properties

THERE is this to remember, however. A generalization of spring formulae shows that:

$$(4)\quad V = \frac{2\ GPF}{S^2}$$

in which V = volume of metal (cu. in.)
in which G = torsional modulus
in which P = load to be carried
in which F = total deflection
in which S = working stress

This means that for any given amount of work (PF = load × movement) the volume of metal in the spring remains the same provided the stress does not change, the modulus being considered as constant.

The value of this formula may be expressed in several ways:

First, halving the allowable stress increases the weight of the spring four times. In commercial springs—for beds, automobiles, upholstery, and the like—this fact is quite important from the purchasing agent's point of view, and also furnishes trouble for the wire and spring manufacturer.

Second, if a phosphor bronze or other alloy is used with a lower modulus and lower allowable stress, the weight of the spring is increased proportionately to the volume and specific gravity.

Third, once the spring is designed, and the proper cross section determined, an infinite number of combinations of width and thickness of rectangular wires could be worked out to meet any combinations of load and total deflection within the range of possible manufacturing limitations.

It is not possible unfortunately to draw every foot of wire the same size and the effect of this variation is immediately evident in a spring. Also, it is impossible to hold the spring diameter absolutely constant, and a certain variation is unavoidable in length. In general, then, the more closely loads and dimensions are specified, the more expensive the spring becomes by reason of individual inspection and testing being necessary. A variation of 0.001-in. in the wire size as, for example, from 0.079 to 0.080, will change the load 5 per cent, and a difference of 1/32-in. in a mean diameter of 1 1/2-in. will change the load over 6 per cent.

(*To be continued*)

Rod and Wire Forming Data and Methods

In the following, which is the first of a series of articles, the author gives considerable valuable information about forming rods and wires

By J. K. Olsen
Chief Draftsman, Stewart-Warner Speedometer Corp.

A PROPERLY planned raw-material estimate should be the result of a careful and complete survey of the product for which the material is required and should insure a sufficient amount of raw material being on hand to produce the required number of parts.

There are a number of factors which may produce a shortage in some extreme cases, but regardless of this fact there should be a safe estimate provided. However, this estimate need not be excessive. An excessive estimate will of course result in an overstock of raw material being left on hand after producing the required number of parts and in this manner the cost of the part is increased proportionately.

Summing up these facts, the ideal raw material estimate is one which is so accurately balanced that it will insure a sufficient amount of stock for the required number of parts with an absolute minimum of excess material at the end of the run. When this ideal condition exists, the cost figures for the product will never be out of proportion because of poor planning and estimating.

Estimating Rod Stock for Screw Machines

IT will be found that in order to approach the ideal condition in the estimate, good judgment will be necessary in determining the allowances for the different factors such as the variation in weights of raw material due to thickness variation and variation of composition. Also, each individual manufacturing concern will have many other conditions which will vary according to the nature of the product, equipment used and the method of handling the raw material.

In estimating rod stock for screw machine purposes it is difficult to determine in advance the number of parts which must be scrapped before the machine is set accurately enough to turn out satisfactory work and several lengths of rod may be used before the machine set-up is approved.

In bent rod parts we have a condition similar to that mentioned and several lengths of rod may be scrapped before accurate parts are finally obtained.

In all rods used for manufacturing purposes there is always a short end piece which must be classed as waste or scrap material.

In stamped or punched parts there is usually a part of the sheet or strip that is unusable and is therefore considered waste or scrap.

In addition to the foregoing examples there is a condition present that sheets, strips and rod stock, etc., may be furnished either on the heavy side or the light side of the required weight by the supplier.

It is impossible to know or to list all the various important factors that can enter into this subject and these few examples of the difficulties with which an estimator may have to contend with should be conclusive evidence that an estimate can never be too carefully made.

In all estimating it is of the utmost importance that accurate data be used for weights of raw-material and an accurate check of most commercial tables will disclose the regrettable condition that the various sizes of stock and the weights listed for them will not figure out to the same constant.

It will be found that in many of these tables the inaccuracy of the constant will vary as much as the difference between the material sizes and consequently the ordinary percentage for scrap may be exceeded by this variation alone.

There are in general very few standards, that is, standards in the true sense of the word for use in computing the estimating material weights. Therefore, it has been my

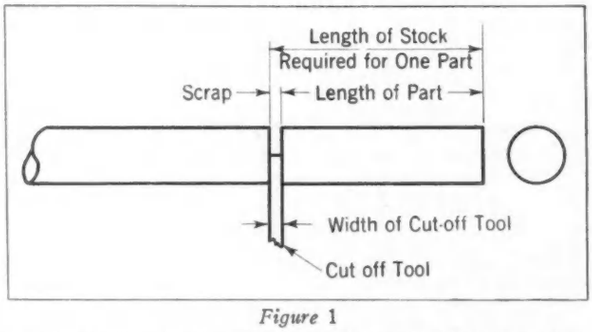


Figure 1

An illustration showing the amount of material that must be allowed for the cut-off tool in the production of such parts as require cutting off in screw machines. More complete information as to the various widths of cut-off tools for different kinds of materials is given in one of the accompanying tables

aim to include only such data and refigured tables that will prove to be accurate and serviceable for both estimating and engineering purposes.

The tables and other data included in the text have been adopted from practical estimating and engineering service and will insure the least number of errors in the average result.

The data and other information included herewith should aid materially in avoiding many of the common errors in planning and estimating.

In the manufacture of parts which use rod or wire stock of the smaller sizes for raw material, it is common practice to shear or clip off this material in such lengths as may be required for each part. In this method of handling the raw material there is no waste from cut-off tools such as are used on the larger sizes of stock.

The total length of raw material required for a given number of parts may be found by multiplying the exact length of stock required to make one part by the number of parts required, plus a safety percentage to insure the desired amount of parts being run. The average safety margin in general use is 5 per cent of the required stock and may be specified in feet per 1000 pieces or pounds per 1000 pieces, depending upon the size and commercial usage of the rod or wire stock.

The shearing or clipping-off operation is sometimes employed in the production of parts in which the larger sizes of rods are used as raw material, due to the saving of stock affected by this method.

This method is sometimes employed in cutting stock in a heated stage and in cases where high priced material such as magnet steel is used, the saving of stock will be found of considerable value.

In the previous description we have covered the plain cut-off operations such as shearing and clipping off which are used to a great extent by some manufacturing concerns.

In the large industries which operate vast numbers of automatic screw machines in the production of extensive quantities of interchangeable parts, it is found necessary to use a method employing cut-off tools. There are many factors which must be considered in determining the width of a cut-off tool, such as the kind of tool, cutting speed, hardness and kind of material, etc., and these have a great influence on the final selection of the tool providing the matter is to be handled in an intelligent and efficient manner.

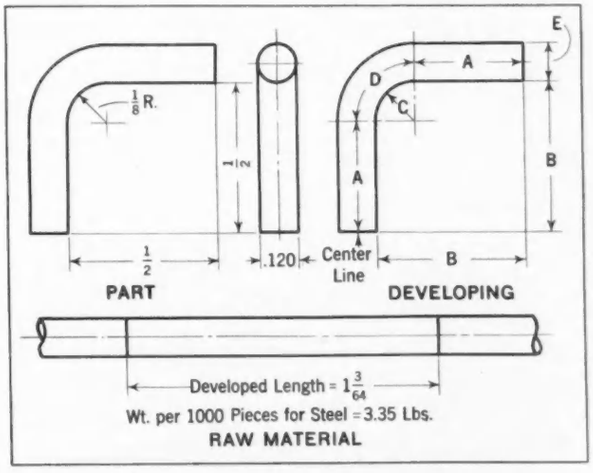


Figure 2

Here is an example of the simplest kind of formed rod. How the developed length of stock material required to make the part is fully explained in the article. It will be noticed that three steps are required to determine the length of stock to allow for the piece, including waste

There are several tables in use which give the width of cut-off tool in relation to diameter and kind of stock to be cut. However, in cases of large quantities of parts, it is very good practice to check the factors determining the tool width and compare this result with the figure given in the table. As the table gives a figure sufficiently large to cover any manufacturing conditions, any decrease in tool width which may be found practical will of course result in a saving of stock.

In Figure 1 it may readily be seen that the amount of material removed by the cut-off tool must be added to the length of the part in order to obtain the length of stock required for one part.

The total amount of raw material required for a given number of parts may be found by multiplying the amount of stock required for one part (which, of course, includes the cut-off allowance) by the number of parts required and adding the customary 5 per cent of total material for a waste allowance.

Various Widths of Cut-Off Tools

IN view of the number of factors that enter into the selection of cut-off tools, only a general lineup of widths can be given. However, the following table of widths has been in practical use and the sizes are of sufficient accuracy to be used in the estimating of raw material.

This table is of merit in respect to the comparatively few tool sizes used and this will undoubtedly have a tendency to decrease the number and sizes of tools carried in stock.

Width of Cut-off Tools
Brass Rod

Diameter of Stock	Width of Cut-Off With Hole	Solid
1/32 to 5/16 incl.	1/16	1/16
21/64 to 1 incl.	5/64	3/32
1-1/64 to 3 incl.	1/8	3/16

Steel Rod

Diameter of Stock	Width of Cut-Off With Hole	Solid
1/32 to 9/32 incl.	1/16	1/16
19/64 to 1 incl.	3/32	3/32
1-1/64 to 3 incl.	1/8	3/16

Since many types of formed rods and wires are cut off in screw machines before the forming operation, it is highly essential to know the width of the cut-off tool in order to allow for the waste material in estimating the amount of stock required for a specified number of parts. This information is set out in the table above, which gives the various widths of cut-off tools for both solid and hollow rods of different diameters and different materials

The widths of cut-off tools shown in the accompanying table are to be used for figuring weights of rod stock. One width of cut-off for each piece is added. To the length of rod a 5 per cent allowance percentage for scrap should be added.

For brass rods larger than 5/16-in. diameter with drilled hole or hollow at point of cut-off use cut-off tool listed in column designated "WITH HOLE."

For steel rods larger than 1-in. diameter with drilled hole or hollow at point of cut-off use cut-off tool listed in column designated "WITH HOLE."

For solid rods use cut-off tool listed in column designated "SOLID."

For other material than steel or brass, use width of cut-off tool for metal with nearest characteristics.

All dimensions given in inches.

(*To be continued*)

If You Are Planning to Make

Electrical Instruments for

A view of an indicator for a magneto type tachometer, with a maximum pointer movement of about 270 degrees. Photograph supplied by the Bureau of Standards, U. S. Department of Commerce

Without considering the military market for electrical instruments in aircraft the manufacturer still has three possible outlets for his products—

1.—Transport Planes
2.—Individually-owned Planes
3.—Flight Test Work

IT IS natural that manufacturers whose programs allow for expansion should be looking toward the airplane industry as a possible new outlet for their wares. It is believed that the maker of electrical instruments who would like to enter this field seriously must prepare to furnish the industry with some instruments that are not now available to the public. For this reason it is intended to point out in what ways some of the present electrical instruments fail to meet aircraft requirements.

There is no thought of telling the electrical instrument manufacturer how to design his product, but rather of citing the conditions under which his product will be expected to render satisfactory service. The requirements for instruments for use in aircraft differ from those in the usual laboratory as regards a combination of sensitivity, vibration and temperature characteristics, size, finish, and scale form, which will now be considered.

Sensitivity—The sensitivity required of these indicating electrical instruments of course varies with their use. The following examples are typical of the requirements to be met by instruments to be used with some devices.

The resistance thermometer in use at present by the Navy for flight test work functions satisfactorily with an instrument whose resistance is 35 ohms and which gives a change in scale reading of one mm. for a change in current of 20 microamperes. Such an instrument, however, is not obtainable in a case of the standard size.

One of the factors in making an electric tachometer of the commutator-condenser type suitable for service or commercial use is the availability of a 300 degree instrument in a 2 3/4-inch case, with a resistance of 30 ohms and a sensitivity of one mm. deflection on the instrument scale for a current of 25 microamperes.

Indicators for use with direct current earth inductor compass generators should have a resistance greater than 30 ohms and a current sensitivity of one mm. of scale deflection per 7.5 milliamperes. The high resistance is specified so that the resistance of the brushes at the commutator will be negligible. The instrument should have the zero at the center of the scale.

A reliable alternating current earth inductor compass might be made available if a galvanometer with a separately excited field and a deflection sensitivity of 1 mm. per one one-hundredth of a microwatt were available. This refers to the power dissipated in the moving coil, which may be of any convenient resistance.

Price—It does not appear to be immediately necessary that an instrument be built to sell for a given price. It must, of course, compare favorably in all respects, including price, with existing instruments intended to serve the same purpose; but it need not be built to sell in the automobile instrument price class. The need of the industry is primarily for long lived reliable instruments and not cheap ones. The growing demand and resulting increase in production should be sufficient to soon place any good instrument in a ready selling price class.

Vibration Performance — All instruments intended to give satisfactory performance on the instrument panels of heavier-than-air craft should have their moving parts so

BELOW is a photographic reproduction of the instrument board installed in Major Young's Stearman plane (rear cockpit), with which he recently made a tour of Europe. There is a total of fourteen instruments on this instrument board, constructed by the Pioneer Instrument Corporation of Brooklyn, N. Y.

for Aircraft

Mr. Whitman's intimate discussion of the requirements for electrical instruments in aircraft will aid YOU in comprehending the conditions under which your product will be expected to render satisfactory service

By V. E. WHITMAN

*Bureau of Standards**

**Publication Approved by the Director of the Bureau of Standards of the U. S. Department of Commerce*

An airspeed indicator, which shows the present trend in case design of aircraft instruments. The dial is 2¾ inches in diameter. Photograph supplied by the Bureau of Standards, U. S. Department of Commerce

light in weight and so balanced as to be unaffected by vibration. Very little quantitative information relative to the vibration of instrument panels is available. It seems safe to say, however, that in the planes now available and under construction, no device will be satisfactory which will not function indefinitely while being vibrated in any direction with an amplitude (i.e. one-half total maximum excursion) of 1/64 of an inch at a frequency of 40 complete vibrations per second. The device must be free from any mechanical resonance effect for vibrations of a lower frequency than that just given. It seems quite improbable that these vibration requirements will be materially lessened in the near future. All instrument design tendencies should be to meet them as far as is physically possible, without the use of any special mountings such as springs or sponge rubber. As was intimated in the first sentence of this paragraph, the instruments which must be designed, within themselves, to withstand vibration, are those which must be mounted on the control panels built as part of the planes. The practice of insulating radio equipment from mechanical disturbances will probably continue so that such strenuous requirements as listed above will not be asked of the instruments which are normally placed on the panels of these sets.

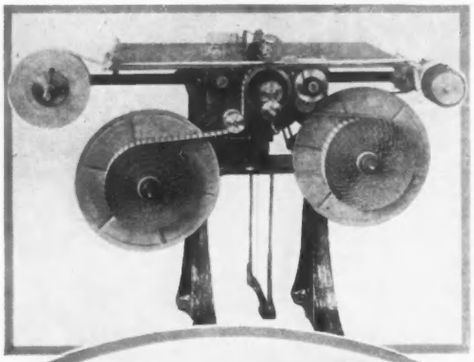
BELOW is a view of the instrument board installed in Major Young's Stearman plane (front cockpit). This board contains a magnetic compass, bank and turn indicator, air speed indicator, climb indicator and altimeter This instrument board was constructed by the Pioneer Instrument Corporation of Brooklyn, N. Y.

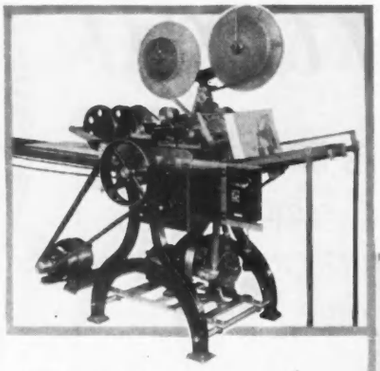
Temperature Compensation—Instruments for use on aircraft should indicate correctly over a temperature range between approximately plus 125 deg. Fahr. and minus 30 deg. Fahr. Clearances and materials must therefore be so chosen that changes of temperature throughout this range will not cause mechanical binding or excessive play in the moving parts. It is not possible to state unqualifiedly at this time that the electrical characteristics, such as resistance and flux density in the air gap, should be independent of temperature. Considering any complete circuit, this must be approximated, but the complete circuit must be known before the temperature characteristics of the indicating instrument can be specified. A circuit with an apparently unavoidable positive temperature coefficient must be provided with an indicator with a negative coefficient. It may be that different elements of a circuit must be so placed with respect to engines and outside air as to be at different temperatures. Such a condition must be taken into account in considering temperature compensation. This is by no means an imaginary condition. It is now encountered in many electric tachometer installations. The electrical compensation must, of course, be undertaken with a full knowledge of such mechanical phenomena as the variation of hair-spring stiffness with temperature. This last mentioned effect is usually in such a direction as to make less electrical compensation necessary than would be required if no springs were present.

Protective Coverings—Instruments must be immune from troubles arising from exposure to high humidity. In particular, all oxidizable surfaces must be protected. In gen-

(*Continued on page* 68)

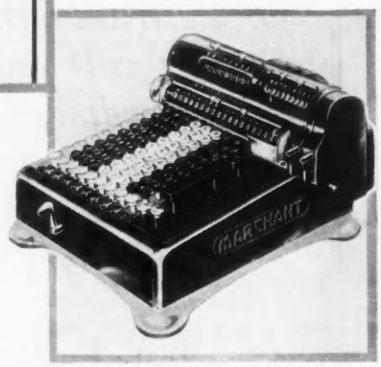
Here is a Market for E





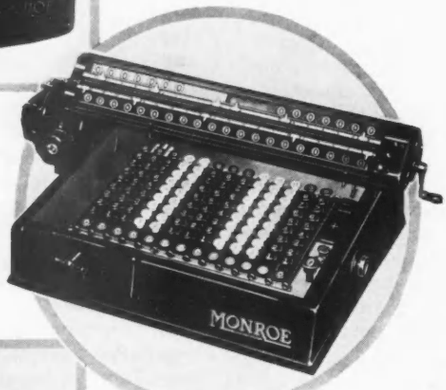
AN automatic addresser for newspapers and publications, equipped with two ½-hp. motors, is pictured at the left, and below is an electrically driven calculating machine, using 1/20-hp. motor, 13 feet of attachment cord and control switch

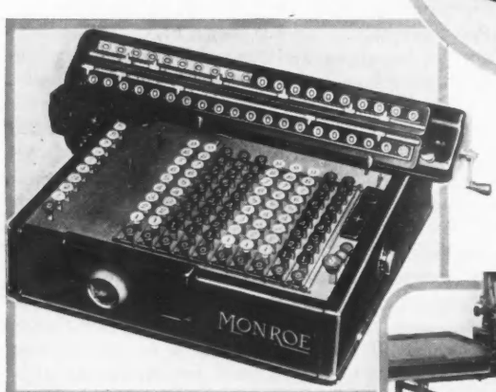
AT the left is shown an adding calculating machine, equipped with 1/30-hp. motor, 8 feet of cord, and two switches. A motor driven addresser is illustrated at the left, above, which calls for a ½-hp. motor



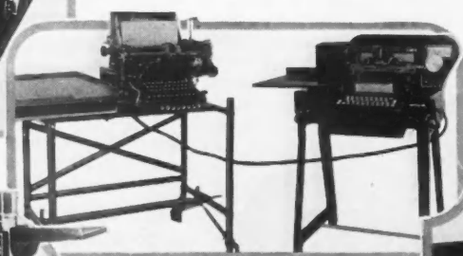
AN electric adding calculator is reproduced at the left, with a 1/30-hp., single-phase, 65 to 225 volts A. C. and 6 to 250 volts B. C. motor. The standard attachment cord is 8 feet, and there are two switches, one an auxiliary toggle type. An electric adding machine, shown below, uses a 1/9-hp. universal motor, 8 feet of cord

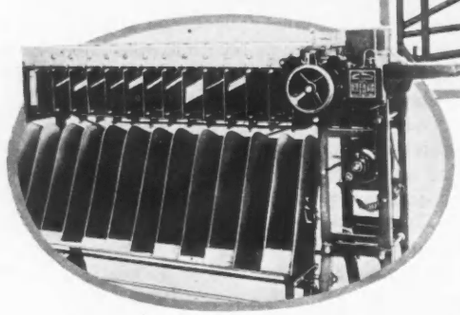
A FULL automatic adding-calculating machine, equipped with a 1/30-hp., single-phase, 65 to 220 volts A. C. or 6 to 250 volts D. C. motor is reproduced below. This machine, besides using a motor, requires 8 feet of cord and two switches. One switch is an auxiliary toggle type device



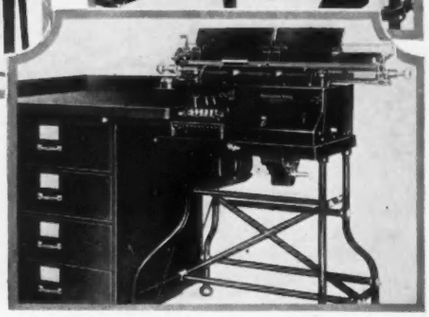


BELOW are shown several of the different models of the various types of alphabetical key punches, with typewriter connections, electrically driven, employing ⅛-hp. motor, with 10 feet of attachment cord



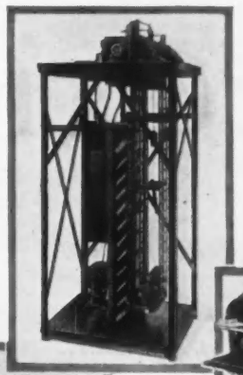


A PLAIN sorter, with an automatic feeder, electrically driven, using ⅛-hp. motor, with 10 feet of attachment cord, is illustrated at the left. At the right is shown a dual bank bookkeeping machine, with same motor, cord, and a switch

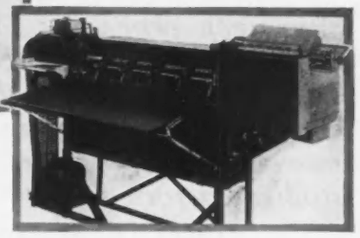


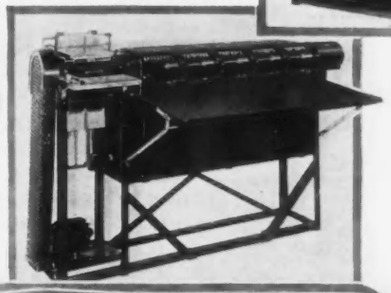
Electrical Equipment

AN extensive and lucrative market for the manufacture of electrical equipment is to be found in those industries producing office business machines. Adding, calculating, mailing, addressing, duplicating machines, cash registers, and kindred devices of this kind require that motors, control switches and attachment cords be of the finest quality to assure long life under long periods of office usage. The desk electric calculating machine illustrated at the extreme left, below, calls for a 3½ in. square over all 1/40-hp., 110-220 volt motor. With it there is 12 feet of cord and an automatic control switch



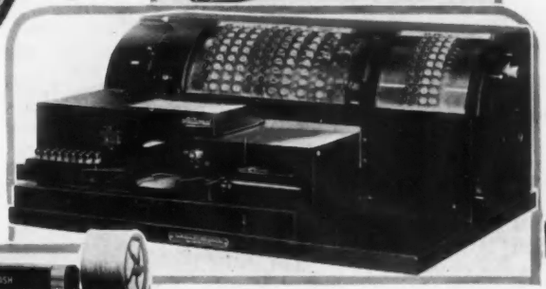
A VIEW of an electric sorting machine, designed to conserve space, is shown at the left, while an electric accounting machine is pictured below. Both of these machines require motor, switch, and attachment cord in their manufacture

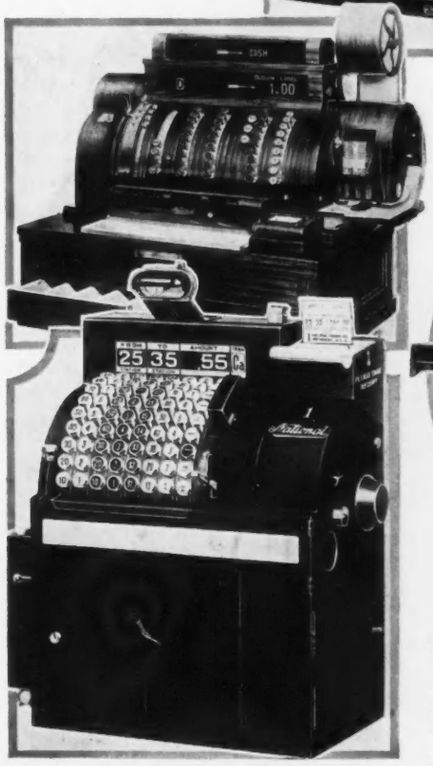




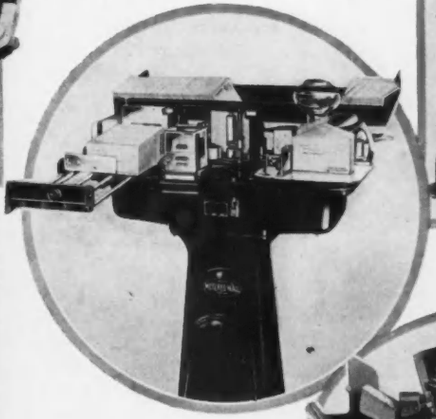
AN electric tabulating machine, automatically controlled, is shown at the left, above. At the left, below, is a view of an electric hotel posting machine which uses a ⅛-hp., series-wound motor, approximately 6 feet of attachment cord, and a special control switch. Directly beneath this caption is illustrated a stamp affixing and envelope sealing machine which employs a ⅛-hp. vertical motor

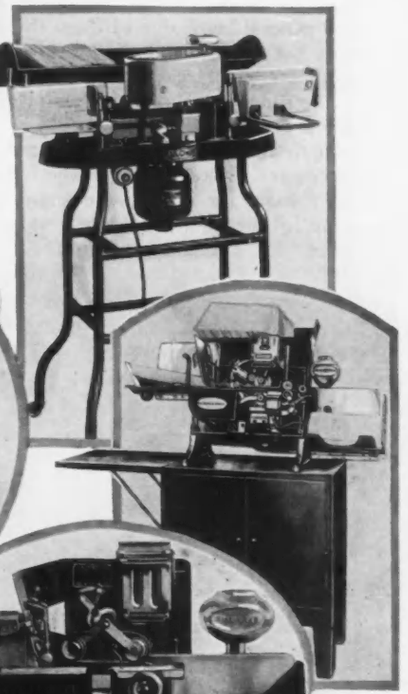
BELOW is shown an electrically operated receipt, slip, and detail slip printing cash register. Under it is a fare register, both using ⅛ hp.

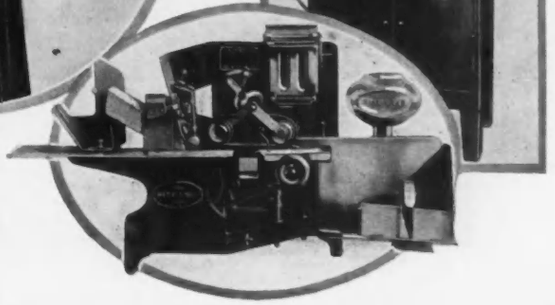




AN electrically driven mailing machine is pictured below, into which is built a ¼-hp. motor. Ten feet of attachment cord is required







MOTORS of ⅛ hp. are used in the mailing machines at the right, center, and above, and 10 feet of attachment cord is supplied with each machine

Cost Analysis of Electric Heating Problems

The application of electric heat to any given process is largely determined by plant conditions. These must be studied thoroughly and the effect of various heat sources on the product must be studied before the proper heat source is selected

By R. M. Cherry

General Electric Company

IN considering the application of electric heating to any process the problems are:

(1) In general, is the process an application for electric heat?; (2) What type of equipment should be used?; and (3) Cost analysis.

Applications of Electric Heat

IN order to make the proper analysis of the application it is necessary that the power salesman have a very good general knowedge of these three points.

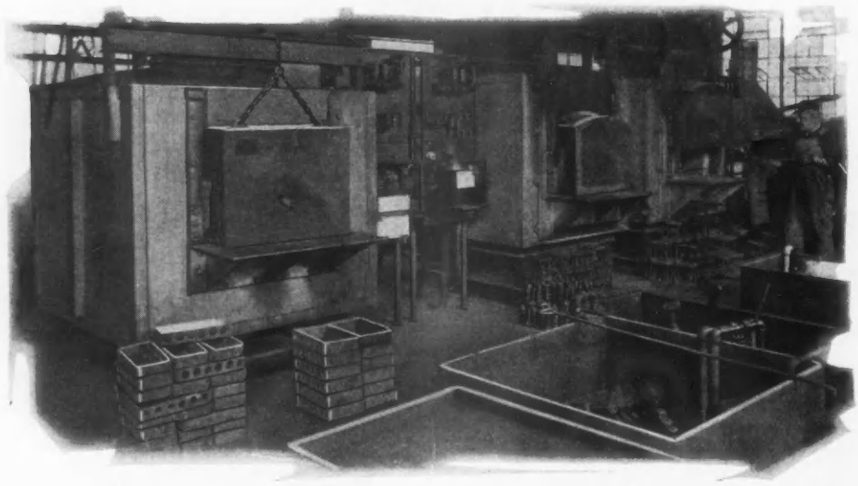
What is not an application of electric heat for a given process in one plant may be an application for electric heat for the same process in another plant as the condition may vary a great deal.

In order to analyze a particular process certain information is necessary. A tabulation of the information not only serves as a basis for making the analysis but also serves as a guide in checking the process at any future date if the first analysis does not result in the application of electric heat.

The following is given as a guide in obtaining data pertaining to a process that is being considered as an application for electric heat.

1—Process (copper annealing, etc.).
2—Maximum temperature.
3—Material to be heated and sizes (drawings or sketches of parts desired).
4—Efficiency of loading (lb. per cu. ft., etc.).
5—Complete heating cycle.
6—Production (lb. per hour, per day, etc.).
7—Working schedule (hours per day, days per week).
8—Voltage, phase and frequency of electric circuit or circuits available.
9—Size and type of furnace now used.
10—Present method of heating and handling, including costs.
11—Size and type of furnace desired.
12—Electric rate that will be charged for power for the application.
13—General information.

The name given a certain process does not necessarily convey the complete heating cycle as there may be many different heating cycles for one process. Steel casting annealing is a very good example, where the heating cycle is not exactly the same for any two plants, for the cycle will vary with the type of casting, size of castings, anneal desired, etc.



THREE 20 kw., 220 volt, single phase, 60 cycle heat treating furnaces, installed at the Ross Gear & Tool Co.'s plant in Lafayette, Ind., are shown in the illustration at the left.

Electric heating devices can be started automatically and will continue to operate indefinitely until they are automatically shut down. The saving in labor resulting from this is obvious. The ease of distributing electric heaters in furnaces and the absence of flames has given added impetus to the application of automatic furnaces.

Type of Equipment

AFTER a thorough study of the process, including the method of handling, the next problem that is presented is approximately what type, size and rating of furnace is required. Below is a list of the most common types of furnaces and the photographs included show typical installations of these types of furnaces.

1—Batch Type	2—Continuous or Semi-Continuous	3—Counter Flow: Continuous and Semi-Continuous
(a)—Box	(a)—Conveyor	(a)—Conveyor
(b)—Car Bottom	(b)—Roller Hearth	(b)—Pusher
(c)—Elevator	(c)—Pusher	
(d)—Lift or Bell	(d)—Rotary Hearth	
(e)—Pit		

This list of the common types of furnaces is very general, for each type listed could be sub-divided many times. For example, a conveyor furnace may be divided into as many types as there are types of conveyors.

Often the nature of the process, the size and shape of the parts to be heated, the production or working schedule will immediately determine the type of furnace required. Many times a very thorough analysis of the condition will be required to determine the proper type of furnace. In making such an analysis it is not necessary to go so far as to determine the exact type in detail but mainly to determine whether a batch or continuous type should be used.

Cost Analysis

THE desirability of electricity for heat treatment is today unquestioned from every standpoint but that of cost. A superficial investigation of costs is often unfavorable to electric heat but a thorough study of the many factors entering into the heating cost of a product sometimes presents the opposite picture.

The preparation of comparative heating costs is a difficult problem involving many factors that are often overlooked or disregarded. This can be better appreciated when we consider on the one hand that the total cost of electricity for heat treating a product is usually less than 1 per cent of its total cost, and on the other hand the quality of the product is widely influenced by the character of the heat source.

That the cost of electricity is only one of the many items in heat treating costs will be gained by a brief consideration of the following items affecting the cost of the product:

Cost of Heat Source.
Labor.
Interest, Depreciation and Obsolescence.
Maintenance—Continuity of Service.
Quality—Rejects Subsequent Operation.
Working Conditions.
Advertising Features.

Cost of Heat Source

Ratio of Fuel and Electric Costs for Average Conditions at Full Load

Cost per 100,000 B.t.u.	Ratio	Ratio 50 Per Cent Combustion Efficiency	
Oil at .06/gal.	$.044	1	1
Gas at .80/1000 cu. ft.	.145	3.3	3.3
Electricity at .015/kw-hr...	.44	10	5

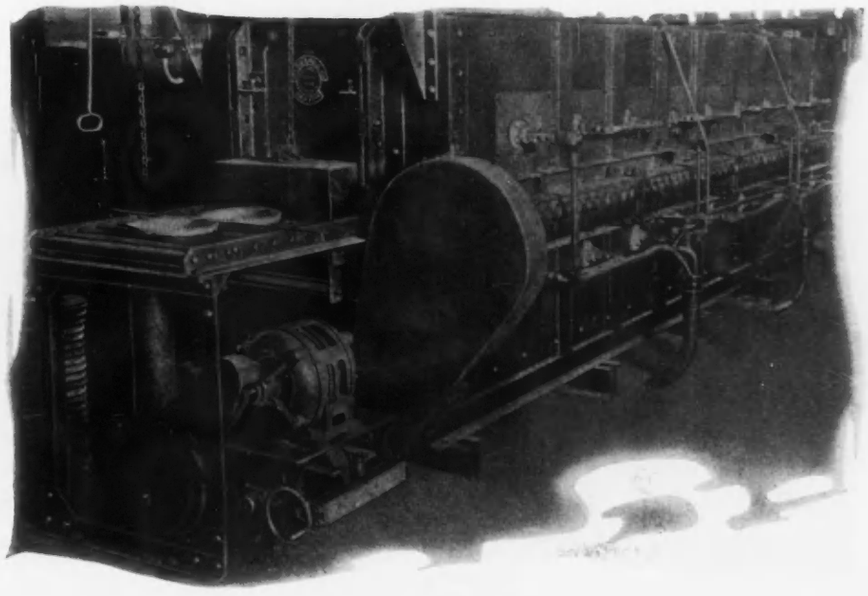
Assuming an average combustion efficiency for fuels of 50 per cent (the conversion of electricity to heat is always 100 per cent efficient), the ratio of cost of useful B.t.u. is shown in the above table. If we add 2 cents per gallon to the oil for burning costs, this ratio becomes 1 to 2 1/2 to 3.7. For the conditions assumed this probably represents a true ratio of costs when operating continuously at full load.

During idling periods the only loss from the electric furnace is that loss by conduction through the walls. These losses can be made very low by the use of suitable insulation.

The fuel fired furnace has, in addition to the wall losses, the combustion or flue losses. Table 1 based on actual test, giving standby losses of gas and electric furnaces, clearly illustrates this advantage to the electric furnace.

Table I—Standby Losses of Gas and Electric Furnaces

Usable Dimensions of Heating Chamber			Gas Furnaces		Electric Furnaces	
Width	Length	Height	Cu. ft. to Hold at 1600° F.	Cost per Hr. at 80° per M cu.ft	Kw-hr. to Hold at 1600° F.	Cost per Hr. at 1½c per Kw-hr.
18 in.	36 in.	18 in.	190	$.15	6	$.09
24 in.	53 in.	20 in.	260	$.21	9	$.135
36 in.	83 in.	23 in.	440	$.355	16	$.24



THE roller hearth-type furnace with removable electric heating units shown at the right is used for heat treating gears. Line or production installations reduce floor space for handling operations; reduce expense of handling facilities and reduce the quantity of material in process through more expeditious handling.

The first cost of electric heating devices is often higher than other types, but careful scrutiny of costs must be made to determine what this means. These costs should include all auxiliary devices, stacks, etc., and the cost of floor space for the complete equipment.

The following examples taken from actual production records show how widely actual costs vary from calculated costs based on assumed combustion efficiencies such as those given previously. This deviation is largely due to this important factor of standby losses.

Example No. 1

Two car bottom furnaces, one electrically heated, and one heated by fuel oil, with 6 ft. by 17 ft. motor operated cars, are installed in the same building and used for heat treating turbine parts. The following is a record of production, electric current and oil consumption. The heat treatment consists of heating to 1500 deg. F., quenching and drawing back to 900 deg. Fahr.

Type of Furnace	Production	Energy Consumption	Cost per Cwt.
Oil	209,507 lb.	15,184 gal. at $.06	45 cents
Electric	309,130 lb.	114,700 kw-hr. at .0125	46 cents

Example No. 2

In a gear treating shop equipped with various box type oil and electric furnaces the following six months production record was obtained.

Type of Furnace	Production	Cost per Ton
Oil	1046 tons	$6.79 (6c. per gal.)
Electric	1056 tons	4.84 (1¼c. per kw-hr.)

Example No. 3

A week's record was obtained on two 8 in. lead hardening pots—one gas heated and one electrically heated, as follows:

Type of Pot	Production	Energy Consumption	Cost
Gas	1000 lb.	14,180 cu. ft. at 80c.	$11.34
Electric	1000 lb.	375 kw-hr. at 1½c.	5.65

The comparison of fuel and electric costs on the basis of relative full load efficiencies is also misleading in the case of many heating operations where the parts heated must be protected from the flames and products of combustion in the fuel fired furnace and no similar protection is essential in the electric furnace. The annealing of sheet steel is a familiar example. In the fuel fired furnace the weight of annealing boxes is approximately equal to the weight of sheet steel. The following record of cost illustrates the advantage of the electric furnace:

Type of Furnace	Energy Consumption per Cwt.	Cost per Cwt.
Oil	3.68 gal. @ 6c.	22c.
Electric	10.8 kw-hr. @ 1¼c.	13½c.

In many cases more direct application of heat can be made electrically than with fuel, thus increasing the difference in efficiencies. Impregnating tanks, which must be heated by some intervening medium such as circulating oil in a fuel-fired installation, can be heated by the direct application of electric heaters.

Solder and babbitt pots and oil tempering baths can be heated electrically by immersion units while with fuel heating the heat must be applied externally.

While fuel costs are often lower than the electric these illustrations indicate the many possible variations from full load continuous operation with direct heat that tend to reduce the cost ratio to one favorable to electricity. Some element of these variations is present in almost every heating process and must be given careful consideration in a cost analysis.

Quality, Rejects, Subsequent Operations

HEATING often imparts entirely new physical properties to a product. It is well known that these properties are widely influenced by the nature of the heating operation. Essentials of proper heat treatment are uniform temperature distribution, accurate temperature control, operation on a proper time cycle, proper and unvarying atmospheric conditions; and it is of first importance that all these conditions remain constant from day to day.

It is evident that electric heat by the nature of its generation, which is usually effected by the passage of current through a resistor, can best meet these requirements. The temperature of the heat source is relatively low, the heat distribution is unvarying, automatic control and quantity input are readily and accurately applied, and there are no contaminating influences in the furnace atmosphere.

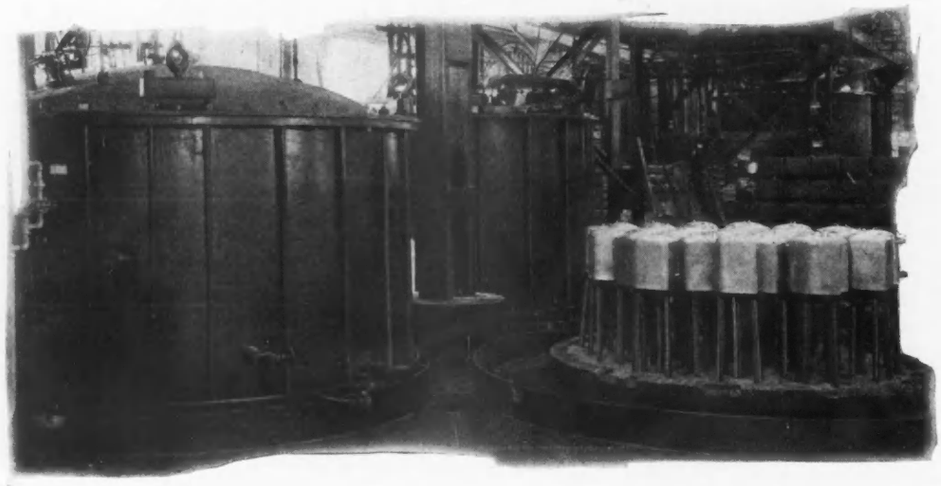
Variations in the character of the heat source, as previously stated, affect the quality of the product and consequently its cost. Any cost analysis, therefore, that does not include a thorough study of the effects of the various heat sources on the quality of the product and properly credit the one yielding the highest quality, is incomplete.

When comparing quality with cost differences of heating processes, it is of interest to know the relation of these cost differences to the over-all cost of the product.

In the case of the distribution transformer it will be found that the total heating costs covering annealing of punchings, impregnating of coils and baking of tanks, are less than ⅓ of 1 per cent of the selling price.

An analysis of the cost of electricity for heat treating and the total cost has been made for a large variety of steel products. The percentage of electric costs to total cost varied from ¼ of 1 per cent for a high grade product to 2 per cent, for bulk heating of a low grade product.

It is evident, therefore, that quality as it affects manufacturing costs or salability may be an item of far greater importance than that of the cost between electricity and fuel.



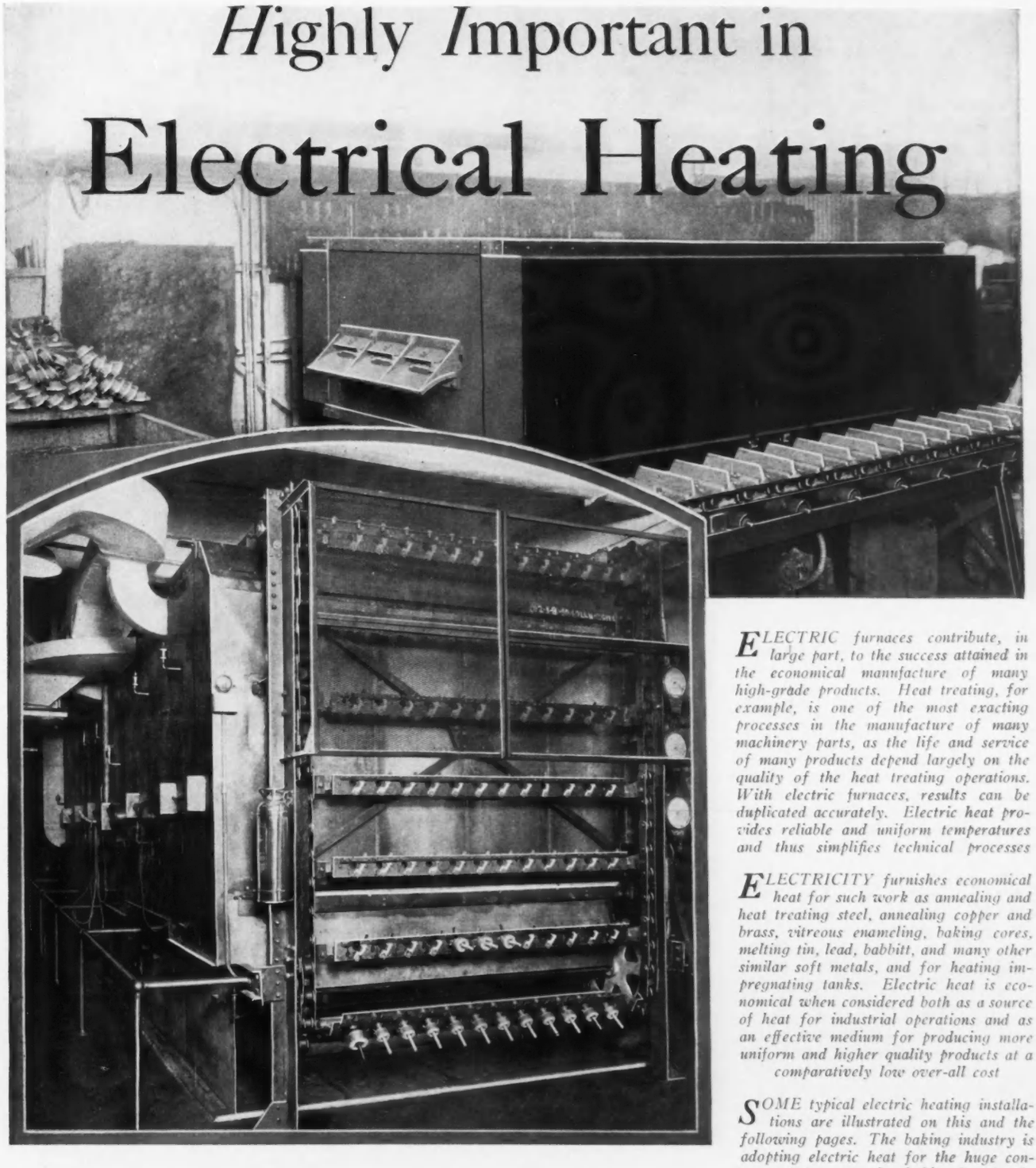
THE illustration at the left shows a three-stage hydrogen brazing furnace 7½ ft. in diameter by 3 ft. high and requiring 400 kw., 220 volts, three phase, for its operation

Comfort and safety to the employees working in plants using electric heat insures loyalty and cooperation and lower labor turnover. Actual savings through the reduction of elimination of liability insurance have been effected

Auxiliary Apparatus

*H*ighly *I*mportant in

Electrical Heating



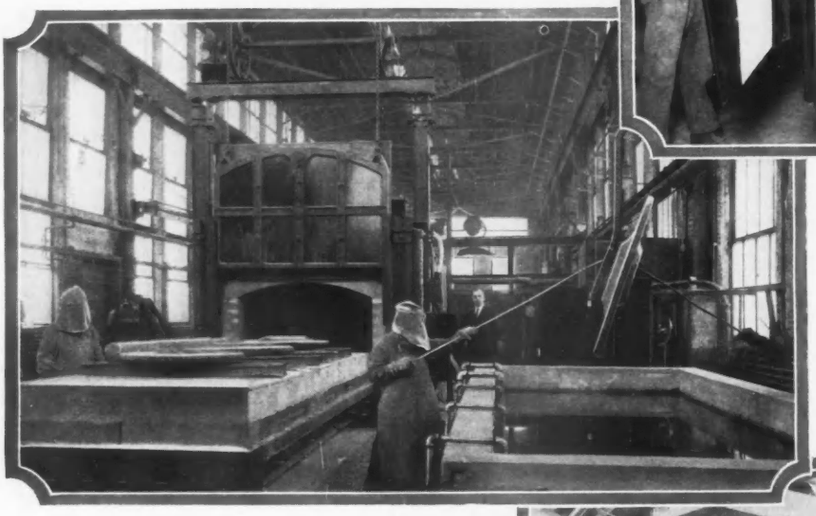
AT the top of this page is an 80-kw., 220-volt, three-phase, pusher type, temper drawing oven as it is used in an automobile manufacturing plant. Directly above is an automatic oven for dipping and baking small motor armatures. It has three separate compartments. The armatures are first preheated, next dipped and baked, then dipped and baked a second time, after which they are returned to the front to be unloaded. One man is required to operate the oven

ELECTRIC furnaces contribute, in large part, to the success attained in the economical manufacture of many high-grade products. Heat treating, for example, is one of the most exacting processes in the manufacture of many machinery parts, as the life and service of many products depend largely on the quality of the heat treating operations. With electric furnaces, results can be duplicated accurately. Electric heat provides reliable and uniform temperatures and thus simplifies technical processes

ELECTRICITY furnishes economical heat for such work as annealing and heat treating steel, annealing copper and brass, vitreous enameling, baking cores, melting tin, lead, babbitt, and many other similar soft metals, and for heating impregnating tanks. Electric heat is economical when considered both as a source of heat for industrial operations and as an effective medium for producing more uniform and higher quality products at a comparatively low over-all cost

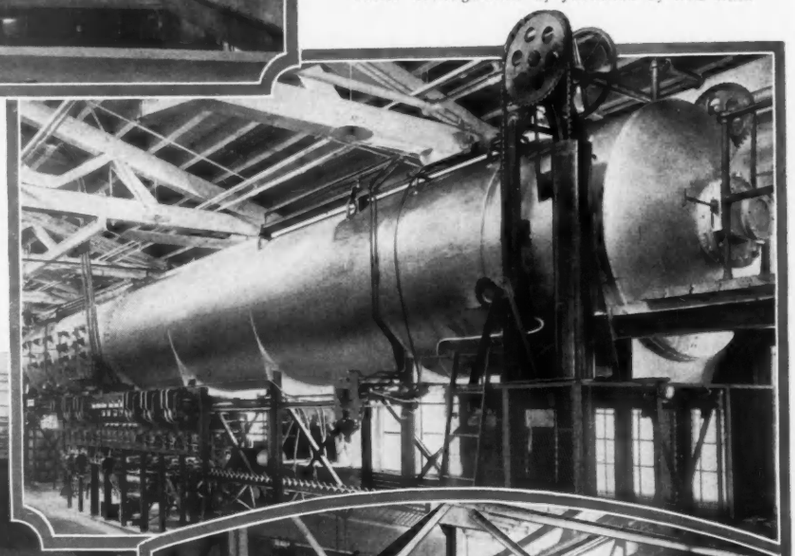
SOME typical electric heating installations are illustrated on this and the following pages. The baking industry is adopting electric heat for the huge conveyor type ovens for baking bread; the glass industry for annealing bottles, plate glass and special ware; the newspaper industry for melting type metal for line casting machines and for stereotype casting. In the automotive industry many ovens are in daily use for baking enamel and for treating castings and metal parts

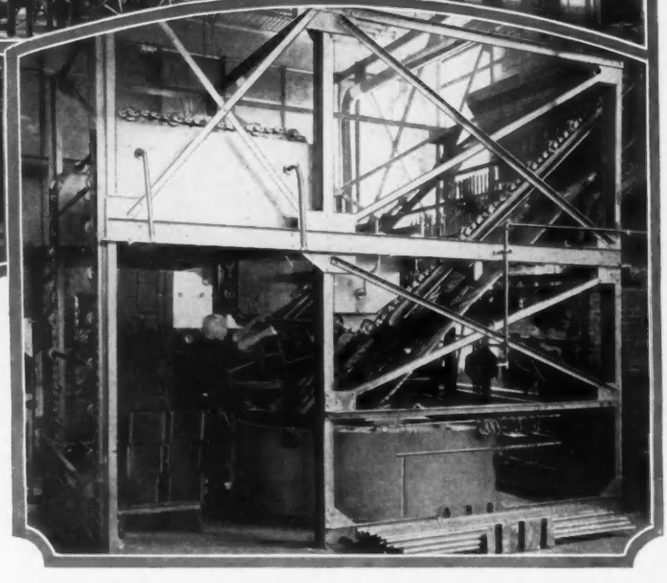
AT the right workmen are hanging enameled parts on a conveyor of a 575-kw., 220-volt, three-phase continuous enameling furnace in the plant of the Edison Electric Appliance Company. In such heating installations as this the parts pass through the furnace on a motor driven endless conveyor whose speed is so regulated that ample time is allowed in the oven for thoroughly drying the enamel. As can be appreciated in such installations, accurate control is maintained over the time the parts are heated and the temperature at which the oven is kept. Below is an electric annealing furnace of the "car type" as it is used in the River Works of the General Electric Company at Lynn, Mass.



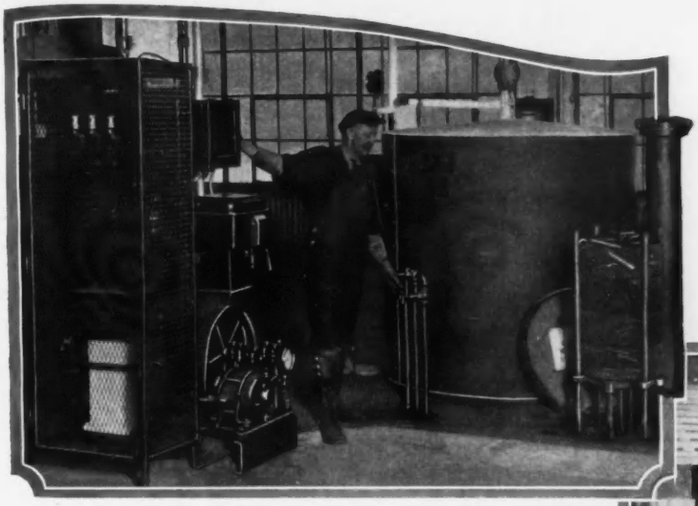
DIRECTLY below is a bright-annealing furnace for copper wire. In the drawing of copper wire from the rods and bars, the copper has a tendency to harden, and for this reason must be annealed frequently between the drawing operations. Then, as the copper will oxidize or scale readily at temperatures necessary for annealing, it is necessary to exclude all air from the annealing furnace, which accounts for the rather peculiar arrangement of furnaces of this kind

THE furnace shown in the illustration above is 17 ft. deep, 6 ft. 3 in. wide and 2 ft. 5 in. high. It has a total connected load of 240 kw., three-phase, 220 volts, and experience shows that the cost of its operation is approximately the same as that of the oil furnace it replaced

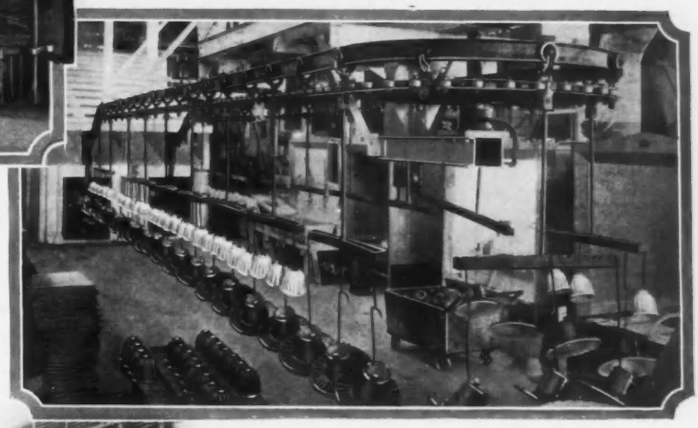




ABOVE may be seen a group of elevator furnaces and some of the annealed loads as they are employed by the General Electric Company for annealing sheet steel plates for large transformers. At the right is another form of conveyor oven, showing the entrance end and the dipping tank. It is 6 ft. wide and 70 ft. long, and is employed for japanning a variety of miscellaneous parts. A horizontal partition separates it into an upper drying oven and a lower baking chamber

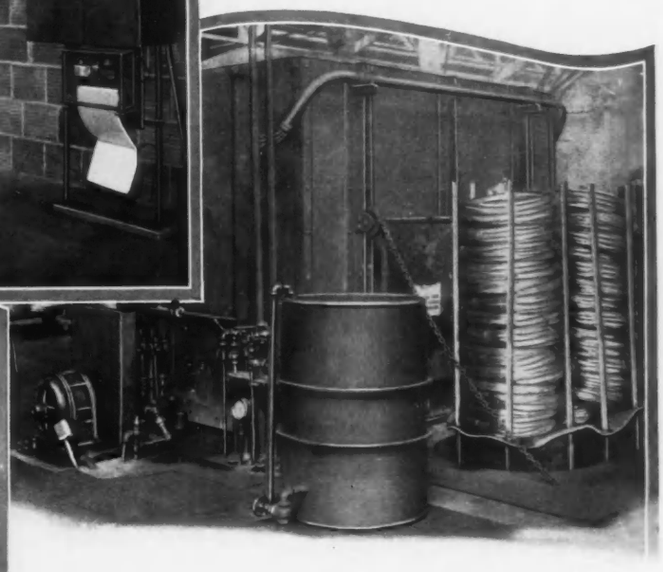


BELOW is an air-sealed continuous enameling furnace as it is used for vitreous enameling cast iron and sheet steel reflectors and flat steel sheets. Electric furnaces are particularly well suited for vitreous enameling. The atmosphere is clean; temperature distribution is uniform; the response or "come-back" is quick from charge to charge, permitting a high output, and a product of exceptional uniformity. In such furnaces conveyors are used extensively when the volume of material and the nature of the work will permit of handling in this manner. In this particular installation the conveyor is of the continuous type, traveling on an overhead monorail



THE heating equipment shown above is used in the Baltimore plant of the General Electric Company for annealing small copper parts. It has a capacity of 400 lb. of parts per hour at 1200 deg. The total connected load in this case is 40 kw., 110 volts, three-phase. Below is a section of the heat-treating room in the plant of the Bantam Ball Bearing Company, South Bend, Ind.

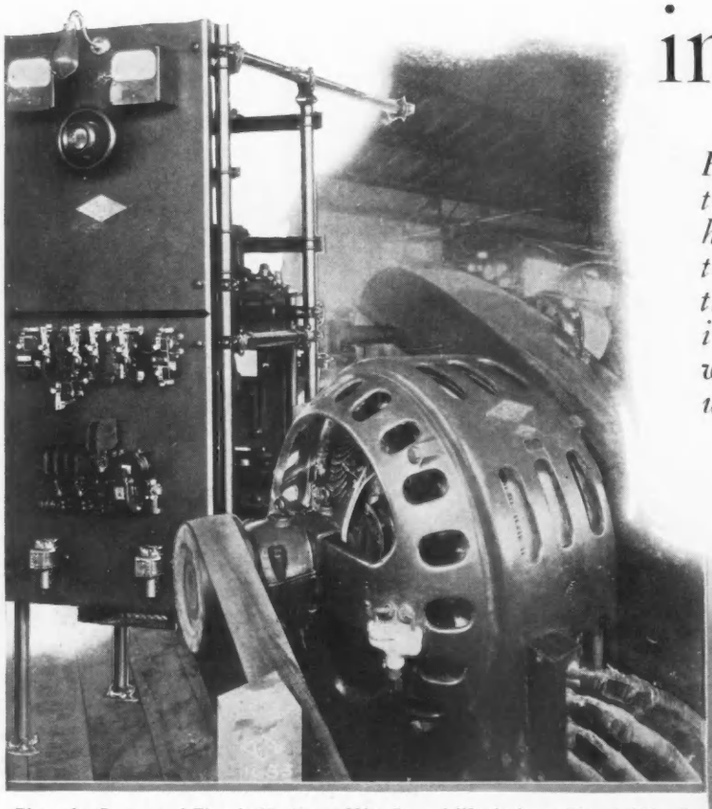
BELOW is another bright-annealing furnace for copper wire as it is used in the Schenectady plant of the General Electric Company. This particular furnace has a capacity of 6000 lb. per charge and the connected load in this case is 300 kw., 550 volts, three-phase. The copper wire annealed in such furnaces is bright and clean and of uniform softness



AT the left is an electrically-heated galvanizing furnace. In this operation the various parts are dipped into molten zinc. Transmission line hardware, sheet steel and other parts for outdoor substations are galvanized in such furnaces as this. Zinc is chemically active when in the molten state, and its corrosive action on the container increases very rapidly with the temperature. Accurate temperature control is therefore an important factor in prolonging the life of the container

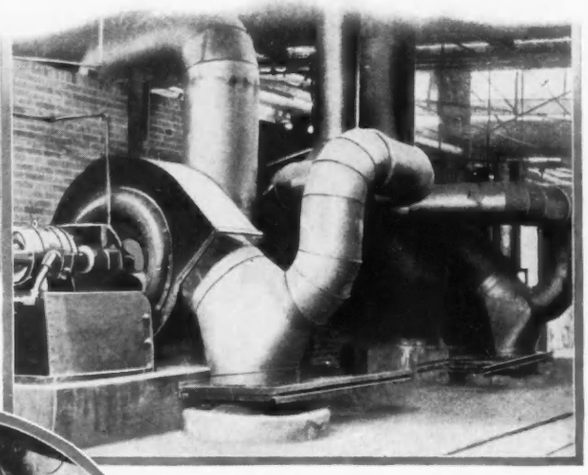
Motors and Control in Brick Plants

Possibly the most important factor in the development of the brick industry has been the application of electricity to the machines and processes used in the manufacture of brick. The growing importance of this field makes it worth the consideration of every manufacturer whose equipment can be used in it

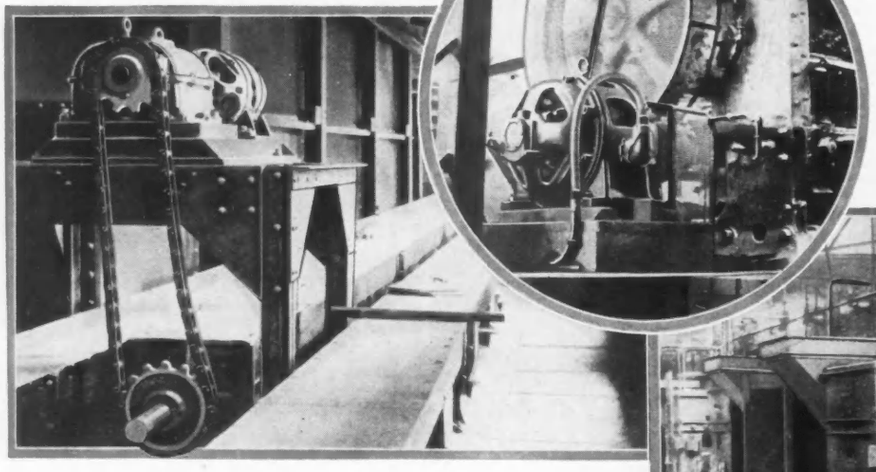


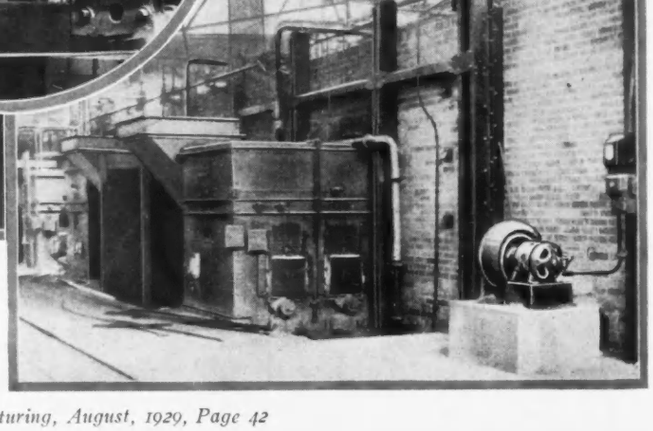
Photos by Courtesy of Electric Machinery Mfg. Co. and Westinghouse Elec. & Mfg. Co.

BEFORE electrical equipment can be operated satisfactorily in brick plants it must be designed to withstand the conditions imposed by this service. Because of the dust laden atmosphere, the motors must be protected by enclosing shields and the control equipment must be mounted where dust will not hinder its operation. Above is shown a synchronous motor installed in a brick plant and also the control panel and other auxiliary apparatus



ANOTHER use of electricity in this industry is illustrated above, where a motor is shown driving the cooling air fans in the tunnel kilns of the Harbison-Walker Refractories Co.'s Templeton, Pa., plant. The uniform quality of bricks has been attained largely through the use of electricity as a source of power





THE inset shows a motor operating press for fire-clay brick; above is a motor driven speed reducer and chain drive on a conveyor, and at the right is a motor direct connected to fan, all in the Harbison-Walker Refractories plant

"Service" is Important in Motor Repairing

Keen competition in the motor repair business today has brought about an ever changing condition in which it is highly essential that the customer receive quick and efficient service

By CHARLES L. SMITH
Treasurer, Smith & Burritt, Inc., New Haven, Conn., as told to

WILLIAM W. BAXTER
Associate Editor, Electrical Manufacturing

TO insure that his customers receive a full measure of service and the best in workmanship, Charles L. Smith (above), treasurer of Smith & Burritt, Inc., 51 Crown Street, New Haven, Conn., takes an active part in the business. He is shown at the test board examining a motor

"SERVICE! Quick, dependable service, is the foundation upon which we have builded our business," said Charles L. Smith, treasurer of Smith & Burritt, Inc., at 51 Crown Street, New Haven, Conn., when asked to what he attributed the success of his organization.

"In this business, if you can't take care of your customers when they need you most, then you'll not stay long in the business. Of course, good workmanship and fair prices are also to be considered. Service, without these, doesn't mean much to users of electrical equipment.

"Maybe I should have said service, good workmanship and low cost comprised the foundation upon which this organization is built.

"Competition is keen today. If we are not on our toes every minute, we stand to lose, maybe some work, and possibly one of our regular customer's business. It pays to be on the alert, and we always try to be. There is no job too small nor too large for us. We will tackle anything electrical.

"Now we are swamped with fans. It seems that during this last spell of hot weather every fan in New Haven got out of order. Look at our small motor department! Those men are working overtime to catch up.

"Over there in that corner is our radio department. Incidentally, and possibly you already know, few motor repair shops are fitted, or even qualified to recondition radio apparatus. We are. We don't specialize in radio, however. Our work is that of taking care of motors, control apparatus and other electrical equipment. Our slogan is, 'We Repair Everything Electrical,' and we are prepared to do just what that slogan says.

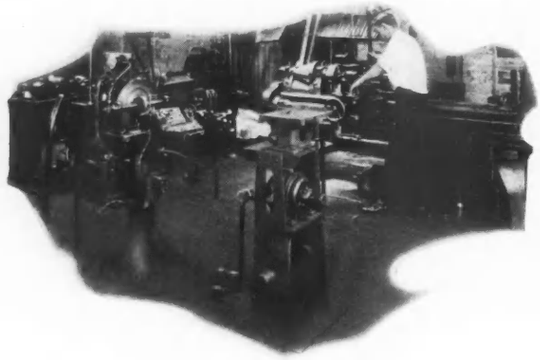
"Here, for example are some vacuum cleaners, there are some irons, over here are some toasters. We get everything in here and we have the men and facilities to take care of it.

"However, this small stuff, such as fans, cleaners, radio and the like, is only incidental to our industrial work. That is our specialty. Most of our work comes from the industries in and around New Haven, but, as we advertise, 'We Repair Everything Electrical,' we don't turn anything down."

"Mr. Burritt (H. E. Burritt, Secretary of Smith & Burritt, Inc.), and I have been in this business for

THE motor repair shop proper of Smith & Burritt, Inc., occupies all of a two-story building in the rear of their storeroom, which is shown above. While the sale of appliances and electrical apparatus is only incidental to the motor repair work, this organization has a pretentious office and sales room

years. We realize that motors, control apparatus and other things electrical do fail, or at least, occasionally get out of order. Otherwise, we would not be here. And, so long as we are here, we are going to do all we can to live up to our slogan. Not only that, we are going to give the best



This is but a small section of the machine department in the motor repair shop of Smith & Burritt, Inc., at 51 Crown Street, New Haven, Conn. In the view may be seen a testing machine, lathes and some of the smaller apparatus and equipment needed for electrical repairs

we have at what we consider a fair price, as long as we remain in this business.

"Ours is not what you would call a big organization. We only have five men here in the shop besides myself, but they are all skilled mechanics.

"Do we do any contracting, such as house or industrial wiring, as many other motor repair shops do?

"None whatsoever.

"We have set ourselves up in the electrical repair business. We profess to be able to repair or recondition anything electrical, and that is as far as we go. All the wiring we do is that of connecting or disconnecting a motor, or something of the sort, when we are called upon to make repairs.

"Contracting, that is, installing house or industrial wiring is a business in itself and we leave that up to the contractors.

"We have enough to do right here in our shop without cutting in on those fellows. Live and let live is the way we look at that side of the business. If we did both repair work and contracting no doubt we would be cutting in on some other fellow's business. On the other hand, contractors here in New Haven know that that is our policy and as a result they throw considerable repair work our way.

"Of course, we know that it is a general practice, all over the country, for motor repair shops to do wiring, but we have never gone into it, and what is more, we don't propose to.

"Some motor repair shops, in addition to doing contract work, are also dealers in electrical equipment and appliances. We do a little of that. You possibly noticed that we have a nice show room and office in our other building at the front where there is ample opportunity to display and sell appliances and the like, but what little of that we do is only incidental to our repair business.

"Emergency or rush calls in the business?

"Plenty. I just returned from one. It will serve to show what I meant when I said 'Service' was the foundation of our repair business.

"One of our customers phoned to say that he was having trouble with an elevator motor. I left immediately and inspected the motor. Off hand, I could not tell exactly what the trouble was, except that there was a short in the motor. I called the service department of the makers of the elevator and their men will deliver that motor to us late today. Upon returning to the shop I checked up to see that we had everything on hand to completely rebuild that motor, if necessary. My men will tear it down tonight, and tomorrow it will be back in operation.

"That is what I mean by 'service.' We know that the owner of that motor is going to suffer considerable inconvenience, as long as the motor is out of operation, and it is our aim to get it back into service again as quickly as possible.

"Such things happen with us almost daily, and we believe that it is just such prompt, efficient response as this that has built up our organization."

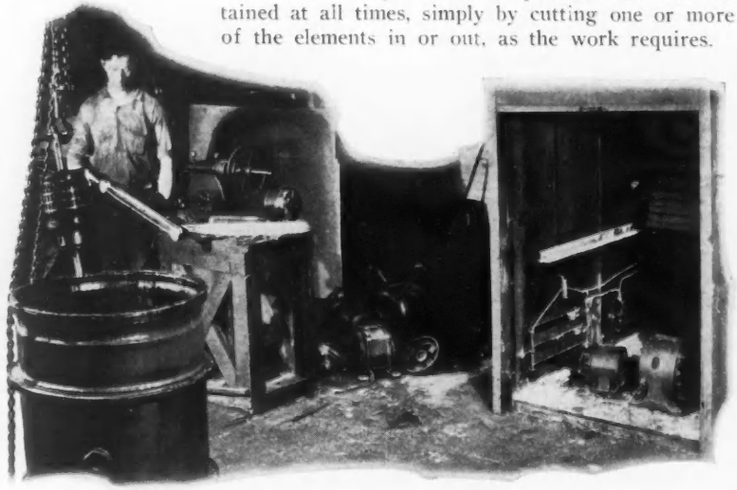
Repair Shop Facilities

IN the way of explanation it might be added that Smith & Burritt, Inc., occupy all of one building and part of another in New Haven. The office and display room fronts on Crown Street, and is on the ground floor of a two-story office and commercial store building. Here are on display such electrical equipment and appliances as are offered for sale and at the rear of the display room are the offices, where all records of the business are kept.

The repair shop proper occupies both floors of a two-story disconnected brick building, in the rear of the office. Storage space for electrical equipment and a garage for trucks takes up the ground floor of the shop. All repair work is performed on the second floor. This is arranged much in the manner of conventional motor repair shops.

There is the usual test apparatus, but in this case, and in addition to the common type of panelboard and connected apparatus, Smith & Burritt have a standard make of testing machine for small motors. Beside this is a small machine for cutting carbons. In another section of the shop is the usual motor repair shop machine tool equipment; consisting of lathes, drills, floor grinding stands and the like.

Of course, there is a coil winding machine, an impregnating tank and a bake oven. This is electrically heated, but not thermostatically controlled. Heat regulation in this oven is obtained by means of an ingenious arrangement of heating elements. These are so installed and connected that a very uniform temperature can be maintained at all times, simply by cutting one or more of the elements in or out, as the work requires.



As is the case in every well-appointed motor repair shop, Smith & Burritt, Inc., have all the necessary facilities for reconditioning practically any kind of electrical apparatus. Above is a section of the shop that is devoted to the winding of coils, the dipping of armatures and the baking of enameled parts

Then, to facilitate in the handling of the heavier jobs there are chain hoists, while portable racks and stands are available for the larger armatures and stators. Compressed air is available at all benches and machines.

As was stated, by Mr. Smith, his organization does not specialize in radio work, yet one corner of the shop is fully fitted with the necessary facilities for testing and repairing this kind of electrical apparatus.

Insofar as records of charges for labor and materials are concerned, Smith & Burritt use a very simple, yet what appears to be very efficient method. It consists of but one form, in reality a card, known as the "job ticket," A reproduction of it is shown with the accompanying illustrations.

Each of these "tickets" bears a shop order number, a space for the date and below these additional lines for the customer's name, address and order number, if he uses any.

Office Records

BELOW these is a space for describing the job, the serial number of the motor and the date upon which the work is promised.

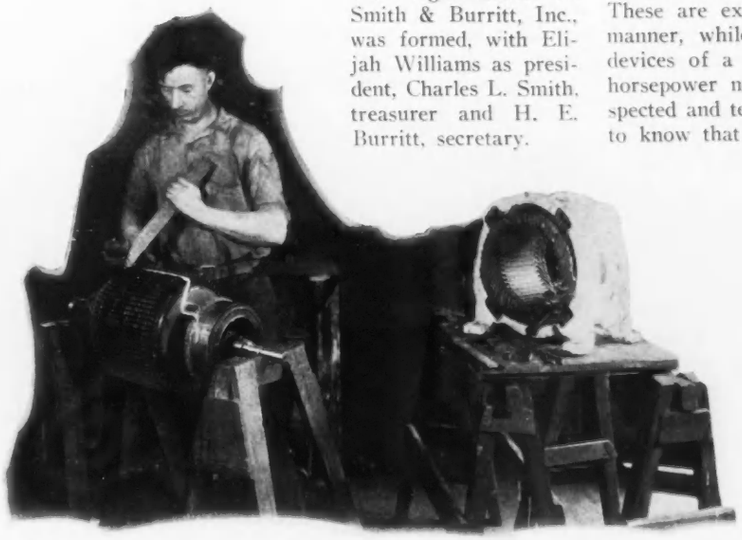
Notice here that "Service" enters even into the planning of the "job ticket," inasmuch as all work is promised for delivery on specified dates.

Another section of the card is arranged so that shop mechanics may list all materials used, what work was done, and the amount of time necessary to do it.

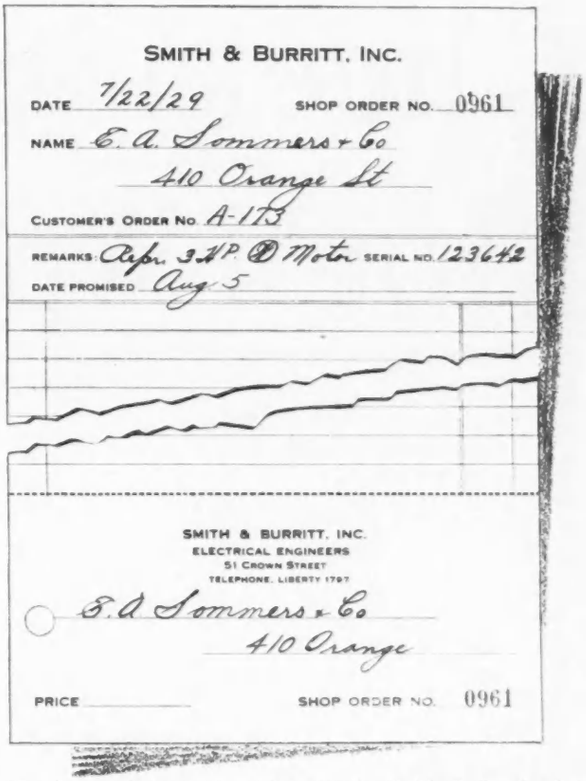
At the bottom of the "ticket" is a detachable stub, bearing the job number, the customer's name and address and the total amount of the charges for the work. This stub serves as a permanent office record, although the upper portion of the card is retained and can be referred to if necessary.

Once the job is completed these cards go from the shop into the office where a bookkeeper enters such items as are necessary upon the books of the company. So, as is clearly evident, Smith & Burritt practice "Service" within their own organization by eliminating many unnecessary forms and records, thereby leaving their employees more available to render better service to their customers.

In a way Smith & Burritt, Inc., is an old organization. It began years ago as the New Haven Electric Company. This company was subsequently taken over by Thomas M. Morris, who continued its operation until about 1925, when the organization of Smith & Burritt, Inc., was formed, with Elijah Williams as president, Charles L. Smith, treasurer and H. E. Burritt, secretary.



In addition to considerable smaller work, Smith & Burritt, Inc., is fully equipped to handle larger motors and electrical apparatus. This work is carried on in a section of the shop separate from that in which fractional motors are repaired. In this section are portable benches and racks and adequate facilities for handling heavy work



To simplify its cost accounting records, Smith & Burritt, Inc., uses but one record form in the repair shop proper. This is shown above. It is a small card that is attached to every job as it is received, and as the work progresses, items of labor and materials are entered upon it, after which these items are copied upon the books of the company in the office

Practically all of the work coming into the repair shop of Smith & Burritt, Inc., is handled about in the same manner as that in other repair shops, similarly arranged. However, in view of the fact that the shop is divided into several different departments there is some little difference in the general procedure. All of the heavy work remains in that section of the shop where heavy motors are repaired. These are examined and tested for defects in the usual manner, while the smaller motors, appliances and other devices of a like nature pass directly into the fractional horsepower motor repair department. These too are inspected and tested. In this respect it should be of interest to know that every piece of electrical apparatus entering the repair shop of Smith & Burritt, Inc., receives the most careful examination and all defects so noted are entered upon the work slip or "job ticket."

Once repairs have been completed, should they have been made to the coils or windings, pulleys, shafts, bearings, frames and bases are carefully inspected for defects such as cracks. If no such defects are found the motors are painted and are then ready to be returned to their owners.

To further enable the organization to live up to its feature of rendering a full measure of service Smith & Burritt, Inc., carry in stock at all times large amounts of wire, insulating materials and such bearings as are commonly used. With these there is also a large stock of pulleys of all sizes and a vast assortment of other materials that ordinarily enter into the repair of electrical apparatus and appliances.

Checking and Testing Motor Applications

*No. 2 of a Series on Electrical Testing Instruments and Methods**

A discussion of those factors that enter into the selection of the proper type of motor for use with machine tool drives

By D. H. Braymer

Consulting Engineering Editor
Electrical Manufacturing

THE polyphase, squirrel-cage, induction motor at the present time is more widely used in all its speeds and ratings than any other type. This is due to its simple construction and its reliability in operation. In spite of this fact there are many misapplications of this motor due to lack of knowledge of its inherent characteristics or too much guesswork in the selection of the motor rating and speed, combined with insufficient information on the starting or running requirements of the driven machine as regards torque and speed over the range of its possible service. Many operating troubles can be avoided by a little study of the motor and the machine characteristics when the motor drive is being designed. If the motor manufacturer is depended upon to do this for the machine builder as far as the motor is concerned, then full data covering the range of the machine's operation should be furnished rather than information on a particular case. Although there is available what is known as a general purpose motor intended for a wide range of service, there are cases where this motor is unsuited and some other design would be a better selection. For these reasons, a brief review of the performance of the squirrel-cage induction motor will be given in what follows from the standpoint of selecting motors to give a maximum of service with a minimum of trouble.

Squirrel-Cage Motor Operating Characteristics—This type of induction motor consists essentially of a group of stator or stationary coils in which a revolving field is produced and a rotating member consisting of bars passing through slots in the surface of the rotor with their ends joined by welding or otherwise so as to make a good connection to short-circuiting rings. This rotor may be considered as a winding made up of closed circuits.

When alternating current is applied to the stator winding, a revolving field is set up and its magnetic lines of force cut across the rotor bars. This action generates a voltage which causes a current to flow in the rotor conductors, producing a tendency for the rotor to revolve. If the rotor were not connected to a load and could operate without friction in bearings or windage, then the speed of the rotor would be the same as the speed of the rotating field in the stator. Under such conditions, however, there

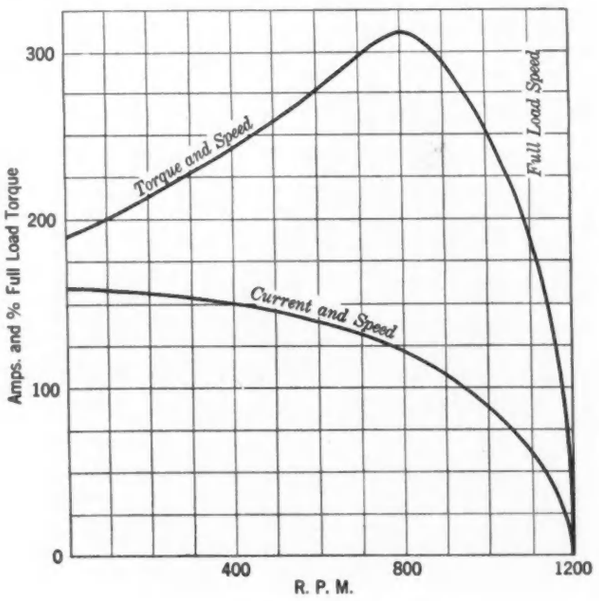


Figure 8

These curves show the relation between torque, current and speed for a 25-hp., three-phase, 60-cycle, 440-volt squirrel cage induction motor, other characteristics of which are more fully explained in the accompanying article

*This is the second of a series of articles having to do with the checking and testing of motor applications. The first of the series was erroneously listed in the July issue of Electrical Manufacturing as article No. 7 of a series relating to the testing of motor drives with electrical instruments.

The Editor.

would be no current flowing in the rotor bars and no torque. When a load is connected to the rotor shaft the rotor speed drops slightly below the speed of the rotating field resulting in the cutting of more lines of force and generating more voltage with more current flowing through the closed rotor bar circuits to produce the torque required to keep the rotor revolving under its load.

The speed of the revolving field in the stator is known as the synchronous speed of the motor and the difference between this speed and the rated full load speed of the motor is known as its slip, usually expressed as a percentage of synchronous speed. Squirrel-cage motors of different makes and speeds will have a slip from 3½ to 5 per cent at full load. At no load the speed will be close to synchronous speed.

Since it is the voltage generated in the rotor that forces the current through the rotor circuits, the value of this current and consequently the rotor torque depends upon the resistance and reactance of the rotor winding. Without going further into the theory of torque producing flux, and the design of stator windings, it may be said that every induction motor has a maximum torque value at which it will pull out or stall. A motor with a low resistance rotor will hold up its speed closely to full load value until the pull-out point is reached, while a motor with a high resistance rotor will slow down decidedly with a heavy overload and pull out at a relatively slow speed.

The maximum horsepower of an induction motor is obtainable at a speed greater than that existing at its maximum torque

HIGH-SPEED motors have a somewhat higher maximum torque than slow-speed motors with the usual pull-out torque valves ranging from two to three and one-half times full load rating. Both the maximum or pull-out torque and the starting torque of squirrel-cage induction motors are proportional to the square of the line voltage. This means that if the line voltage should drop 10 per cent, the maximum torque is reduced to 81 per cent of what it could develop at normal voltage and corresponding speed. It is important also to remember that the maximum horsepower of the induction motor is obtainable at a speed greater than that existing at its maximum torque. In the case of hard starting loads or machines subject to considerable overload for short periods, and in outlying districts where voltage regulation is poor, it is important to know that the motor used will start and carry its load without difficulty and that suitable control devices are used to help it do so. It is also well to note that a 10 per cent increase in voltage increases the maximum and starting torque 21 per cent but also increases the magnetizing current and lowers the power factor. A similar change is brought about by variations in the operating frequency since the maximum and starting torques vary inversely as the square of the frequency. Also a high or low voltage may affect the efficiency and the heating of the motor depending upon the proportions of stator copper loss and iron loss in the normal machine and the degree of saturation in the iron.

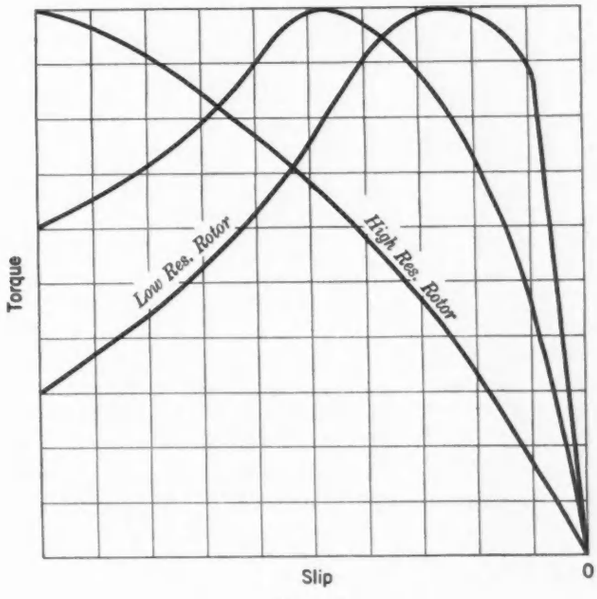


Figure 9

These curves indicated that the resistance of the rotor winding of a squirrel cage induction motor does not affect its maximum torque, but does affect the speed at which maximum torque is obtained

In the selection of motors for machine tool drives there are five essential motor characteristics to be considered

IN connection with what has been said concerning maximum or pull-out torque and starting torque, it should be pointed out that the maximum torque a squirrel-cage motor can exert is independent of the rotor resistance but depends on the reactance of the rotor and stator windings and the ohmic resistance of the stator. However, the speed at which the squirrel-cage motor develops its maximum torque does depend upon the rotor resistance as shown in Figure 9. The higher the rotor resistance, the lower will be the speed at which this motor will develop its maximum torque.

Standard slow-speed squirrel-cage motors in starting will develop up to about 125 per cent full-load torque and high-speed motors up to about 250 per cent full-load torque when full line voltage is applied to the stator. The starting currents under these conditions may be from 3 to 6 times normal running current at full load. The following table is furnished by one manufacturer for starting its standard general purpose motors on full-line voltage:

Poles	Synchronous Speed r.p.m.	Minimum Starting Torque Per Cent.	Approx. Starting Current in Per Cent. Full Load Equal to 75 Per Cent. Locked Rotor Current
2	3600	150	473
4	1800	150	435
6	1200	135	405
8	900	125	360
10	720	120	330
12	600	115	308
14	514	110	292

When selecting motors for machine drives the following information is required:

1—Voltage, frequency and number of phases of the line service.

2—Maximum load to be started by the motor under most unfavorable conditions, maximum load to be carried continuously and how this load varies.

3—Starting torque necessary for the motor compared with full-load torque.

4—Whether full-load speed can be appreciably less than at no load, and how much.

5—Whether speed adjustment is required or advisable on the part of the operator, and if so, how much.

The next section of this article will continue this discussion of induction motor operation and deal particularly with starting requirements for different conditions as taken up in this article.

Specifications are Important in Purchasing Materials

It is practically impossible today to buy any kind of materials without specifications and these should be very carefully planned and drawn

By R. H. Arnold

Material and Process Engineer, Westinghouse Electric & Mfg. Co.

THERE are a few purchasing agents to whom the mention of a purchase specification is an invitation for an argument. They consider a specification to be a ready-made excuse for increase in price by suppliers; they contend that specifications hamper competition and are generally a nuisance to the buyer. Such opinions can be due only to lack of experience with properly written specifications. The large increase in the use of specifications in recent years shows that more and more buyers are coming to realize the necessity of accurate and complete descriptions of the materials they purchase.

It is impossible to enter an order for the purchase of any material without writing a specification, though it be no more than a common trade term. In such a case, however, the specification is not necessarily mutually understood as meaning the same thing by the contracting parties, and may lead to trouble when the buyer does not get the quality he expected. A common understanding of details is an essential characteristic of every contract.

Forms of Purchase

The purchase of materials without having a formal detailed specification must take one of four courses. These are: (a) Use a general trade term, such as "cold drawn screw stock steel." (b) Use some manufacturer's brand name. (c) Request duplication of a former order. (d) Select the material from the suppliers' stock.

With the possible exception of the last, all these methods of specifying are indefinite because the specifications are incomplete. Cold drawn screw stock may vary in the degree of hardness, in variations in diameter, etc. Use of a brand name definitely shuts out competition, and you have no guarantee from the supplier that he is not going to change the material without your knowledge. Duplicating a former order seems safe, but there is a case on record where such a method was used through a period of two years and led to serious loss. On comparing laboratory tests made on incoming shipments during this time it was discovered that a gradual change had been taking place so that the last receipts differed widely from the first. As there was no specification for comparison, these changes passed unnoticed in the laboratory until trouble developed. Selection from stock seems a safe method, but certainly is cumbersome and expensive.

A formal specification removes all these objections when properly prepared. The word "properly" must be accented in this statement for there are many specifications that fail in this regard. Some are so incomplete that they do no real good as a part of the contract; others carry so many non-essential requirements that they prevent the use of the supplier's standard product and cause a decided increase in price. It is this type particularly which has made many buyers suspicious of purchasing specifications and has hampered their introduction in places where they could be made to serve a useful purpose.

There are a large number of properly prepared specifications in use, and many purchasing agents have come to realize their value. All these specifications have several if not all of the following characteristics in common:

(a) They are written with a choice of words and style which leaves no doubt as to their meaning.

(b) They state in a general way the application of the material covered.

(c) The essential properties desired are given, and only the essential properties.

(d) Many give the test methods to be used for checking these properties.

(e) Packing, marking and shipping instructions are outlined.

Terms in Specifications

A little thought will show why these five elements are found in all good specifications. It will be agreed that all parts of a contract must be so worded that everyone reading it will get the same meaning. Technical or semi-technical terms that may have different significance to persons skilled in different trades should be avoided.

All the applications of widely used materials cannot be indicated, but when this can be given it is of benefit to the supplier, as it supplies him with information to enable him to decide points not definitely brought out. Even in a good specification something must be left to the judgment of the supplier.

It is to the item of essential properties that the most thought must be given. It is so easy to imagine many unusual and improbable conditions arising in the use of the material being described that unnecessary provisions will be added, making the supplier reluctant to bid because he is not sure of all the items specified. If he does take a chance, he will be likely to raise the price because of his uncertainty. It should not be necessary in a specification for brass bar stock, for example, to give the percentage reductions between anneals provided the ductility and strength of the finished bar are given and can be determined by easy tests.

The method used in testing is frequently important. The strength of cotton cloth varies considerably with moisture content, and different methods of taking samples will give different results. A change of speed in a tensile testing machine will vary the indicated strength of a strip of zinc. Such instances are so numerous that test methods should always be indicated if not described in detail.

Workable Specifications

In addition to these five characteristics of a properly drawn specification, certain other considerations are important. Wherever possible provisions excluding the suppliers standard product should be avoided. Buyers should keep the engineers specifying materials informed of standard sizes and should see that these standards are followed. This applies to physical dimensions, and particularly to tolerances on these dimensions. Also, the number of sizes being called for should be controlled. The buyer should consider it a duty to protest a situation that requires him to obtain a large number of small lots of material, when proper consideration on the part of the designers could have combined several sizes with relatively large quantities for each lot.

It is not always possible to write a workable specification to cover all the necessary properties of a material completely. Certain properties of materials are not readily disclosed by test and some require such extensive tests that it is not practical to make them. That property of oils which makes the difference between a good and a poor lubricant; the life of a paint or varnish; the tendency of an insulating oil to form deposits under conditions of service, cannot in the present state of our knowledge be determined except by very delicate long-time tests, which could not be used as acceptance tests to check incoming shipments because of the time required.

(*Continued on page* 82)

Spray Finishing Fundamentals

By
PAUL W. COLLINS

In this the third installment of the series on spray painting methods the discussion of various types of equipment is continued

THE preceding installment ended in the last issue with a description of mechanical agitators for use in spraying materials of heavy body or with delicate tints. This section starts with a discussion of various types of air compressors and complete units and also contains some information on spray painting booths.

The Air Compressor—There are air compressors of many types and designs. All are doubtless patterned after proved engineering principles, some more efficient than others. Some compressors heat up more than others. No alarm should be occasioned by the fact that the heat of the air compressor, while in use, does not permit one to put his hand on it . . . especially if it has been running for a while. Compressing air generates heat and naturally the pump will become hot. The electric motor, too, will heat up and is guaranteed by the manufacturer to stand a raise in temperature of 40 deg. Fahr. Compressor units are built in various styles of assembly but may be roughly classified into the following groups.

1—Electric motor driven portable units.
2—Gas-engine driven portables.
3—Electric motor driven stationary units.
4—Stationary industrial units.

Electric Motor Driven Portable Units—This type of equipment was essentially designed for spray painting. Time was when it was patterned after the stationary outfits excepting that wheels were added to the chassis below the tank. This cumbersome design was gradually simplified, made more reasonable in price and greater portability was achieved until today a portable unit consists mainly of the motor and air compressor mounted on a portable base fitted with a handle or wheels or both. A pulsation chamber designed to eliminate the throb of the pump at the spray gun is fitted to the air compressor air outlet. This chamber also serves to catch what oil and condensation there may be at this point.

On portable compressors, the air seldom has sufficient time to cool and condense its moisture before having passed through the pulsation chamber or even an air filter attached to the compressor. The condensation usually takes place in the air hose before getting to the spray gun and goes through the gun in the form of drops of water. On particular work where it is desired to eliminate all moisture from the air, a portable hose line filter should be installed about four feet from the spray gun and some 25 feet from the air compressor. The hose line filter is designed with an inlet and drain at the bottom and the outlet at the top. There is a hook for fastening the filter to the sprayman's belt or pocket. This hose line filter is sometimes used as an auxiliary to the wall type filter on extremely humid days and in similar instances.

The most desirable feature of the motor driven portable unit is the possibility of its being plugged in at any convenient electric lamp socket or wall plug. For this reason it is seldom desirable to have larger than 3/4 hp. motor driven portable for general use. On factory or building maintenance work, however, the wiring in the building is

Figure 16

THE small portable spray outfit shown above is driven by a ¼-hp. motor. This size is popular for touching up lighting fixture parts, machinery, etc., that have had the finish damaged in transit or the customer desires a new color effect

Figure 17

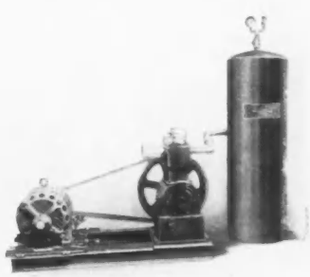


Figure 18

DEPENDING on the amount of air used, a small unit (Figure 17*) of* 1 *or* 2 *hp. or a large unit (Figure* 18*) of* 5 *hp. upward is used. Larger compressors are fitted with water jackets*

sufficiently heavy and capable of carrying a larger current load or it is possible to hook the motor directly to the meter box or switchboard. In cases such as these it is possible to use a 1, 1½ or even a 2 hp. motor driven outfit.

Gas-Engine Driven Portables—This type of portable generally ranges from a 1 hp. gas engine upwards. The units are usually mounted on skids or rubber tired carts to permit easy moving. They are most desirable in outside building maintenance work, new building spray painting, painting of poles in the field, transformer units, oil company properties, railroad equipment, etc. This type of equipment is usually referred to as one, two, or three gun outfits. It is indeed seldom that these large spraying units are used except in conjunction with pressure feed containers ranging in liquid capacity of from 5 to 15 gallons. The most satisfactory gas engine portable is one delivering about 8 cu. ft. of air and operating one spray gun.

Figure 19

AN air conditioning unit combining the filter, pressure regulator and gage and shut-off cocks is generally used because of the compactness of the unit and the elimination of possible leakage and other troubles if the items were scattered along the air line

It should always be borne in mind that the air filter should be drained frequently, and if oil passes through the filter it is sometimes not the fault of the conditioning unit but may lie directly in the air compressor. Many air compressors pump oil after having been used a period of years and either have to be replaced or honed out and fitted with oversize pistons and rings

Electric Motor Driven Stationary Outfits.—This type of compressor is usually found in the garage and similar service members in the automotive field. Manufacturers operating only a few spray guns of small air consumption use this type of compressor unit. It is usual practice to have the compressor pump up to a pressure of, say 150 pounds into the storage tank and at this point the control switch automatically shuts off the motor. When the air is consumed from the tank and the pressure gets down to approximately 110 pounds, the automatic switch starts the motor and shuts it off again when the maximum pressure has been attained. Since the average prescribed air pressure for spraying is around 40 pounds, pressure regulation at the spray gun outlets is necessary. Having this surplus volume and pressure in the storage tank permits the intermittent use of a spray gun of larger air consumption than is delivered by the pump, or one may use several guns of small air capacity all from the central storage tank.

Stationary Industrial Units.—These units are an enlargement of the small stationary automatically controlled outfit just mentioned. They are driven by motors of from 5 hp. upwards depending on the size of the air compressor which will meet the demands of the spray shop and factory. Instead of using an automatic switch for stopping and starting the motor and compressor when the air pressure in the storage tank arrives at the maximum and drops to the minimum, the compressor is fitted with an "unloader." This device permits the compressor to run "idle" during the periods of pressure attainment and when the pressure gets to the minimum allowed, the unloader valve closes and the compressor resumes its labors. These large compressors are practically all water-cooled. The cooler the compressor, the higher is its efficiency.

Some factories, especially those which have a fluctuating demand on their air supply, prefer to have a battery of automatic air compressor tank units, all interconnected. There is relatively little difference in cost between the battery of compressor units and a large outfit, and there is the assurance that one will always have air in his plant because all the units cannot go wrong at one time.

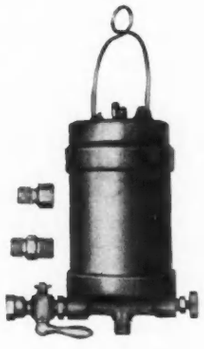
The air pressure maintained in industrial plants rarely exceed 100 pounds at the tank. The reason for this is that it costs just half as much to compress air from 1 to 100 pounds as it does from 1 to 150 pounds and nothing is really gained by having the extra 50 pounds pressure since spray painting is being done at under 100 pounds pressure. For occasions demanding higher pressures, special units are installed.

Air Filtration—Irrespective of what air compressor one uses, there is bound to be condensation of moisture in the air. This moisture lodges in the air tank and all along the air line. This water is invariably oily. The air compressor breathes in dust with the air it compresses and there is bound to be scale in the piping. These objectionable features of compressed air must be eliminated for good results.

Streaks, blisters, bubbles, white or faded spots (called "blushing") are all due to the presence of moisture in the air. If one is spraying on metal, the presence of moisture in the air is most apt to lead to a rust spot forming under the coating. This will result in the cracking and chipping of the finish. If one is spraying lacquers, oil from the air line will retard the drying of the finish and generally shorten the life of the coating. Discoloration in spots and a tendency to peel are the most noticeable ill effects from using oil-contaminated air for spraying lacquers. While varnishes and good grade paints have an oil content, the presence of oil in the air being used for spraying has the same general effect on these materials as on lacquers with the additional result of killing the gloss of the finish in spots.

Figure 20

WITH the pressure fluid feed method, where fluid is fed from the material container to the spray gun through a fluid hose, it is a rule of efficiency that the hose must be flushed out before being put away. If the material is left in the hose, it hardens and either flakes or lumps up. This condition will plug the gun frequently, and the loss in time and spoiled finishes mounts rapidly



Dust and iron scale in the air invariably leave specks and possibly rough spots on the finish. Their presence does not lend to beauty of the product and it takes time and money to polish them out. Adequate air filtration is therefore most vital and essential. The filters should be located at the pipe outlets and the air hose attached to the outlet of the filter unless, of course, the pressure regulator is interposed at this point.

Pressure Regulation—In all instances where a constant, even spraying pressure at a satisfactory poundage is not assured, a pressure regulator should be installed. This type of equipment permits the sprayman to have any pressure he may desire providing his source of air maintains that

pressure or higher. There should be no fluctuation in the function of the regulator. Inadequate regulation of air pressure often causes an unsatisfactory spray job and a waste of material.

Air Conditioning Units—It is correct practice to combine the air filter and pressure regulator into a unit. This way, one is sure that the valve seat and diaphragm of the pressure regulator is guarded against air impurities and the unit is compact and desirable when constructed in this fashion. This unit is termed "Air Conditiong Unit," "Air Transformer," "Filter and Regulator Assembly," etc., by various manufacturers.

Hose—Air hose should be of good quality and light weight so as to permit flexibility and easy wrist movement. On industrial spray equipment (where guns of large air consumption are being used) the air hose to the gun should be 3/8-in. inside diameter and the air hose to the pressure feed tank ½-in. On smaller equipment, a ¼-in. air hose is usually adequate. The length of these hose will depend upon how far away the sprayman has to work from the air outlet. Under no circumstances should the hose be so long as to be constantly under foot of the sprayman.

The fluid hose must be of a superior quality to that of the air hose as solvents (lacquer thinners, turpentine, etc.), pass through it and quickly disintegrate the ordinary rubber hose. Many shops use metal lined fluid hose instead. The fluid hose should be thoroughly rinsed and cleaned immediately after being used and it is best to reserve a different hose for each material and color sprayer because, no matter how well one may do the cleaning, some pigment is bound to stay along the wall of the fluid hose (especially metal lined hose). If a different color is next put through the

Figure 21

The function of the turntable is to enable the sprayman to shoot the surfaces from the best angle and with the best light. A tilting turntable often helps on irregular designs

hose, this pigment might affect its color or tint. Fluid hose should be no less than 3/8-in. and preferably ½-in. inside diameter.

New hose usually contains a soapstone coating. It is well to blow the new hose out thoroughly before using, as it is not conducive to a good finish if this soapstone is left in the hose to mix with the spraying air or fluid.

Fluid Hose Cleaner—The hose cleaner may either be installed as a permanent fixture alongside the spray booth or be retained as a portable device. It is suggested that on portable air compressor units used in maintenance work, etc., this cleaner be attached permanently to the unit. It is most essential to thoroughly clean the spraying material out of the hose after use as it will affect the finish on the next spray job and the least it would do is retard the sprayman's efficiency the following day.

The method of using this hose cleaner is simple. First detach the fluid hose from the spray gun and attach that end to the hose cleaner. The air cock on the cleaner should then be turned on and the fluid blown out of the hose back into the pressure feed container or gravity fluid tank. After the air is shut off, the needle valve on the cleaner is opened. This permits the flooding of the hose with cleaning solvent. The cleaner is allowed to stand in the hose for a few moments before being blown out. If necessary, this rinsing process may be repeated until the hose is sufficiently clean.

Proper Ventilation—The finishing department should be located in a separate fireproof building. If this is not possible, it should be located on the top story with a fireproof and waterproof floor. Such locations permit easier and more efficient installation of exhaust and ventilating equipment. The finishing room should be kept at an even temperature with doors and windows closed. The ceiling should be of smooth construction (no open joists) so that no dust can drop down onto the work being sprayed. Proper arrangements must be made to keep the spray dust from settling about the room. To do this and adequately ventilate the room, the air must be changed every two minutes. The best solution to most of these requirements is found in the spray booth.

The Spray Booth—This should be constructed of noncombustible material. The use of wired-glass side panels in part is often conducive to better light in the booth. The back of the booth is cupped in such a fashion that an even draught will be obtained from the exhaust fan and to further insure this, hinged distributing panels or baffle plates are set ahead of the exhaust fan. On the side of the booth an air transformer should be fitted with one or as many spray guns as the work demands one operator to have at his command. These should be coupled with hose of proper length. An air duster gun should also be hung alongside to assist in cleaning the surface to be sprayed. A fluid hose cleaner and the gravity or pressure feed container should also be part of the equipment. A small open container of cleaning solvent should be within easy reach of the sprayman so that he may occasionally clean off the face of his spray gun, wash his hands or otherwise avail himself of the uses to which it can be put. Lights with proper reflectors should be fitted to the booth so the sprayman will leave no "holidays," and, in the center of the booth, one usually finds a turntable upon which the article or articles may be set and sprayed from all angles.

The spray booths should be separated by a few feet of floor space to permit convenient handling of the articles being sprayed and to help confine a fire should one occur in any of the booths. Except in the case of very small booths used for decorating work and the like, each spray booth should be fitted with its individual exhaust system and, if more than one fan is provided to the booth, the control should be such that one fan cannot be operated without operating all. This insures the proper circulation for adequate ventilation.

The Exhaust—Listed below, in the order of their preference, are the three general methods of exhausting from the spray booth.

1—The ejector type, A blower type fan and motor fitted entirely outside the booth and ducts.

2—Where the fan blades are in the duct but the motor is outside. The blades are connected to the motor by a drive shaft and universal joint.

3—Where the fan blades are in the duct and the motor is outside but the blades are belt driven. The fan belt should be either totally encased or made of a fireproof and non-sparking substance.

The exhaust fan should be located just below or at the level at which the spray gun is being used. The fan blades should be of non-sparking metal. The size of the duct should be large enough to have between 10 and 20 per cent excess in exhaust capacity over the supply of incoming air. The duct should have as few bends, angles or curves as possible because every change of direction of the exhaust pipe retards the efficiency of the exhaust fan. An opening should be located at each bend in the duct to permit the cleaning of any heavy residue that might collect at that point. The duct outlets should be protected so that flying sparks may not enter and where the wind will not interfere with their operation.

Editorials

Looking Ahead with the Electrical Industry

IN a recent issue of a financial magazine H. C. Hopson, vice-president of the Associated Gas & Electric Company made some interesting remarks concerning the central station industry that are of decided importance to every manufacturer of electrical products. He pointed out that there are in this country nearly 25,000,000 light and power users and the number is increasing at the rate of 5 per cent a year. Last year 1,218,000 new service connections were made. At this rate by 1934 or 5 years hence, 6,750,000 new users will be added to the present number of 25,000,000, making a total of 31,750,000 users of electric service.

With the proposals to combine huge networks of electric service distribution and the possibility of even lower light and power rates, the demand for small and large electrical units will be at a higher rate of increase than the rate of increase in service connections. It does not require much strain on the imagination to create a rough picture of this demand during the next five years in small motors for instance, required for vacuum cleaners, electric refrigerators, fans and the like.

Following the time worn but pointed adage about the early bird getting the worm, it is evident that the electrical manufacturers who expect to get their share of business among the possible 6,750,000 new service connections, will be those who follow closely the extensions of distribution lines into new districts and the activity of the larger power companies in the intensified effort that they will put forth to load up new distribution lines and bring those existing up to their estimated capacity.

Estimates by the Federal Reserve system indicate that business volume in all lines increased in 1928 about 3 per cent, while the use of electric service on a dollars and cents basis showed a gain of 11 per cent. This comparison can be taken to indicate one of two things: more and more selling activity is being put behind the products of electrical manufacturers or buyers are becoming easier to sell and more eager to buy things electrical. In any case the market is broad and deep and he who sews wide now and digs deep later will reap the greatest harvest for we are now in the morning of an electrical era with users of electrical service just beginning to realize the economy and the convenience that electrically operated products make possible.

Selecting Motor Enclosures

MANY an application engineer has found from experience that standard general purpose motors will not carry full load when provided with inclosing covers to protect them from falling dirt, moisture, fumes which might injure the windings. Time and again we hear of instances in which a motor has been applied to a machine with no thought whatever to the conditions under which this machine must operate, so far as the surrounding atmosphere is concerned. When such cases come up, the first thought is to provide inclosing covers, and all too often this is done before someone who understands the conditions prevents it.

The job of the application engineer is only partly finished when he has selected the speed and horsepower of the motor required to drive a machine. He must also consider the conditions under which it is to operate and specify a motor that will stand up under the conditions imposed. Dust and dirt in the windings and bearings, moisture dripping on the motor, metallic particles in the air, acid fumes and explosive gases are all hazards to the motor, the surrounding property or both.

A good example of a field in which the motors must be protected if they are to run properly throughout their economic life, is presented elsewhere in this issue in a pictorial article showing the requirements of the brick-making industry. In brick and tile plants the air is laden with dust and grit of various kinds which will find its way into the windings and bearings of the motors if they are not adequately protected.

Motor manufacturers have developed lines of motors fitted with inclosing covers for different types of applications and when the application engineer has a problem requiring one of these motors he should specify an inclosed motor. Using to the full extent the facilities offered by the motor manufacturers in the form of motors with protected windings will not only increase the life of the motor selected and keep in service the machine it drives but will also help to build a clientele of satisfied customers.

Some Benefits of Standardization

ACCORDING to a statement by L. L. Elden of the Boston Edison Illuminating Company, appearing elsewhere in these pages, "Standards may be nothing to enthuse over yet there is a considerable measure of satisfaction in viewing past accomplishments in the standardization field. It is apparent on every hand that this work has already contributed materially to the welfare of the manufacturer and the ultimate consumer in such liberal measure as to warrant recommendations for continued support and prosecution of standardizing activities on behalf of the electrical industry."

Standardization is by no means new in industry, although more intensive efforts in recent years have brought about a renewed interest in the work.

Changing production and marketing methods are largely responsible for these conditions, to say nothing of the influence of possible economies in lower manufacturing costs and the conservation of labor and materials.

However, there are still greater opportunities for considerable more standardization in the electrical industry, and standardization, to be effective, naturally requir the closest cooperation between all interests affected.

There still remains much that can be done in the forming of standards that have to do with processes, dimensions, materials and construction, or take the form of specifications, rules, regulations and codes. Each has its appropriate application, but whether its existence is justified or not depends largely upon the economic advantages derived from its use.

In the matter of safety codes, designed to reduce life and property hazards, no one will dispute the desirability of such guidance, yet the inclusion of mandatory provisions governing construction details may require excessive investment far outweighing any possible advantage accruing from their use.

Failure to control the personal element has been a noticeable weakness in many safety codes.

As one example of what has been accomplished in the electrical industry the case of the incandescent lamp might be cited, as it is one of the best known accomplishments throughout standardization. Selling prices have been reduced 53 per cent since 1914 and 50 per cent since 1920. Standardization of lamp voltages within a range of 100 to 130 volts in 1914 reduced the number in common use from twenty to five. Similar action in 1920 further reduced this number to three. Other important factors in this accomplishment include the adoption of the Edison screw base as a standard for lamps, sockets and fuses, tending toward the simplification of production and marketing.

Standards of rating for electrical apparatus is another problem that deserves attention. Voltage standards is another, and as is generally well known, there are many others in the electrical industry deserving attention tending toward standardization, to the end that both the industry and the consumer will be benefited.

Problems in Spring Design

IN almost every electrical product, springs, in one form or another, are an essential part of the operating mechanism of that product. They hold down brushes, commutators, cause circuit breakers to operate, enable us to measure accurately electrical loads, and in many other ways are an important factor in the operation of electrical circuits, while at the same time they make possible the commercial utilization of electricity for power, light, speech and radio.

Since springs are so relatively essential to the many applications of electricity it would appear that manufacturers of electrical products should understand the fundamental theories of spring design and construction, as well as just what data it is necessary to have in order that a spring may be made to function as it is intended.

Elsewhere in these pages a manufacturer of springs discusses the properties of these devices; the information a manufacturer must have to produce a spring to conform with its specifications, as well as some things to be considered in designing products requiring springs for their operation. These data are supplied in order that the electrical manufacturer might be assisted in designing and making a product that will be economical in construction, and efficient in all of its characteristic functions.

All too frequently spring manufacturers are called upon to produce certain types of springs which they know are entirely impracticable. In other instances products have been designed, requiring springs, with no allowance made for the proper operation of the spring. Orders are often received with insufficient information from which to make springs, all of which results in confusion, many delays and an unnecessary expense to the electrical manufacturer as well as he who makes the spring.

Electrical Apparatus for Aircraft

THERE is an ever-increasing demand in the field of aviation for new types of electrically operated instruments and for improvements in those now in use.

Omitting the military services from consideration, out of whose appropriations the present aeronautic instrument industry has been so largely built, the manufacturer has three possible outlets for his products.

Transport planes are rapidly becoming more and more dependent upon electrical apparatus for communicating certain information from different parts of the plane's structure to the pilot. Mechanical connections between engines and instrument panels are causing a certain amount of trouble in the present types of multi-engined aircraft, and the situation is liable to grow worse as the distance between these elements is increased in larger planes.

The second market for electrical instruments is for that class of planes, which as prices decline, will be made available for individual owners. Here the market will be governed largely by the price of various types of instruments. However, these lighter individual planes, probably powered by a single engine, will not demand the great variety of instruments carried on transport planes. Only such instruments as will be essential to the safety of the plane will be carried and they should never be so cheaply constructed as to sacrifice serviceability.

The third type of flying for which instruments must be built is that of flight test work. Here the demand is apt to be small and concentrated with a few large plane manufacturers and users. Such instruments for this service will demand the greatest possible accuracy, and price will not be so much a consideration.

Realizing that such conditions are to come about in the future, and as an aid in the standardization of certain features of instrument construction, methods of mounting, and performance, the Bureau of Aeronautics, U. S. Navy Department, Washington, D. C., and the Material Division, Army Air Corps, Dayton, Ohio, have prepared some specifications relating to several features of aircraft instruments.

A discussion of other important details of electrical instrument construction is to be found elsewhere in these pages, that should be of value to those concerned with instrument manufacture.

Interest, Depreciation and Obsolescence on Electric Heating Equipment

THE first cost of electric heating equipment for plant processes is often higher than for other heat sources, but the particular process to which it is desired to apply electric heat must be studied in detail to bring out all the features that actually affect the installation. The study of the costs of various types of heat sources should include the auxiliary devices, such as stacks, etc., as well as the cost of the floor space occupied by the various methods of providing heat.

The case of punching annealing, which is described elsewhere in this issue of ELECTRICAL MANUFACTURING in an article entitled "Cost Analysis of Electric Heating Problems," shows some interesting points that sometimes decide the type of heat that will be the most economical. In this case the floor space required for fuel-fired furnace and annealing pots was approximately three times the space required for the electrical installation to handle the same output in one department. Floor space released for other manufacturing operations had a value almost equal to the cost of the furnace installation.

Line of production installations reduce the floor space necessary for handling operations; reduce expense of handling facilities; and reduce quantity of material in process through more expeditious handling. These items may far exceed the cost of the heating equipment and therefore cannot be overlooked.

Depreciation and obsolescence items vary widely with the character of the equipment, but they form an important item in costs. Experience indicates a lower depreciation for electrically heated devices, and it is axiomatic that the most modern device will suffer the lowest obsolescence.

Characteristics That Determine the *Selection* of MOTORS

No. 15 of a Series Discussing Motors of Different Types

The motor and control equipment can usually be mounted so that they require the least possible floor space that might be otherwise used

BY THEODORE SCHOU
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AND

C. P. ROBINSON
Synchronous Engineer Ideal Electric & Mfg. Co.

THE installment of this series in the July issue of ELECTRICAL MANUFACTURING ended with the discussion of control apparatus for rubber calenders, paper calenders, printing presses, cloth printing machines, etc. The following installment continues this discussion and also takes up steel mill drives and crane and hoist applications.

Figure 24 is a group picture showing variable voltage type, two motor range drive controller, motor driven rheostat and push button stations for remote control. This equipment controls two motors, one 5 hp. and one 15 hp., giving push button control of the speeds, dynamic braking, individual inching or running, combined inching or running, and synchronized operation by means of a dancer roll rheostat. Such control as this finds an application in the paper industry and may also be used for any other similar application where speed range control of two motors is desired.

AT the right is shown a motor driven rheostat and push-button stations for use with the variable voltage; two motor range drive controller panel also at the right. This equipment controls two motors one 5 hp. and one 15 hp., giving push-button control of the speeds, dynamic braking, individual inching or running, combined inching or running, and synchronized operation by means of a dancer roll rheostat

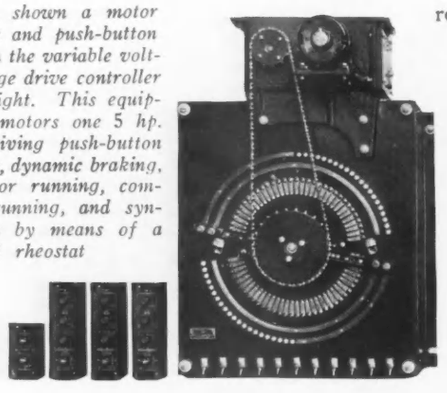


Figure 25 shows an adjustable speed armature shifting D. C. motor driving a circular weaving machine for making the cotton jackets that form the protective covering for fire hose. The motor and control are mounted in a space saving manner. The assembled unit is convenient and compact. Note the simple controller used in connection with the armature shifting motor.

Paper Making Machines—These are usually made up of several sections. The drive may be either from a common line shaft driven by one adjustable speed motor or by individual or sectional motor drive.

The control for a sectionalized paper machine is rather complicated, but a brief outline will serve to bring out the salient features.

Primarily the electrical equipment for a complete sectionalized paper machine drive will usually consist of the following: (when D. C. motor drive is used).

1—An individual direct current motor for driving each section of the machine. The close speed regulation of the shunt wound D. C. motor, and the wide range of speed adjustment obtainable, by both field and voltage control, makes it the most suitable type of motor for this application.

2—A separate D. C. generator for supplying power to the individual motors. The generator voltage may be varied to change the speed of the entire machine. This generator may be driven by any source of power available. A synchronous motor, steam turbine, or any other source may be used.

3—A separate exciter, giving a constant source of direct current excitation for the generator and motor fields is required.

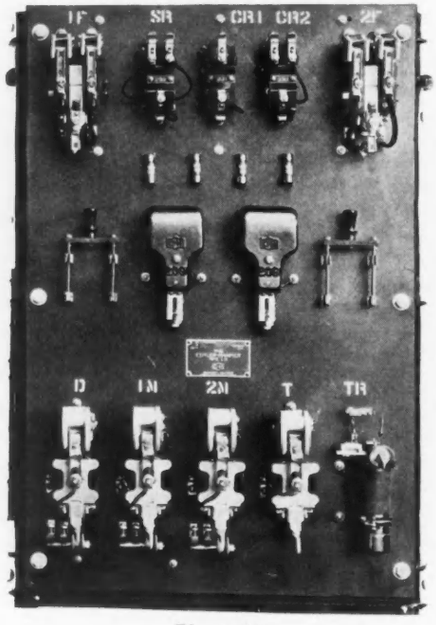


Figure 24

4—A synchronous motor panel, if this type of drive is used for the generator.

5—A generator control panel.

6—A control panel for each sectional drive motor, with automatic motor starter and hand operated field rheostat.

7—An automatic regulating device for maintaining the speed of each sectional motor in its proper relation to the other motors.

A sectionalized paper machine drive of this type has an advantage over the line shaft drive, in that it permits speed adjustments of the individual motor in order to maintain the proper tension on the paper in all stages of operation, thus minimizing breakage, and consequently increasing production.

Steel Mill Drives—Few applications of motors and controllers involve more severe service than is found in steel mills. The motors are started and stopped frequently, usually under heavy loads. Large starting currents are used to obtain quick acceleration.

The direct current series wound motor has been extensively used, although in some cases, the tendency is toward the use of compound wound motors that have a limited maximum speed and reduced commutation troubles. Dynamic braking is often used in connection with compound wound motors.

The applications for direct current motors in the steel industry are many and varied, such as for rolling mills, blooming mills, reversing mills, draw benches, tube mills, etc.

The control for steel mill motors has been fairly well standardized for each application and has been developed for each individual case to serve its purpose to the best advantage, from the standpoints of motor control, starting, acceleration, overload protection, current interrupting capacity, etc., minimizing, as far as possible, maintenance and repairs.

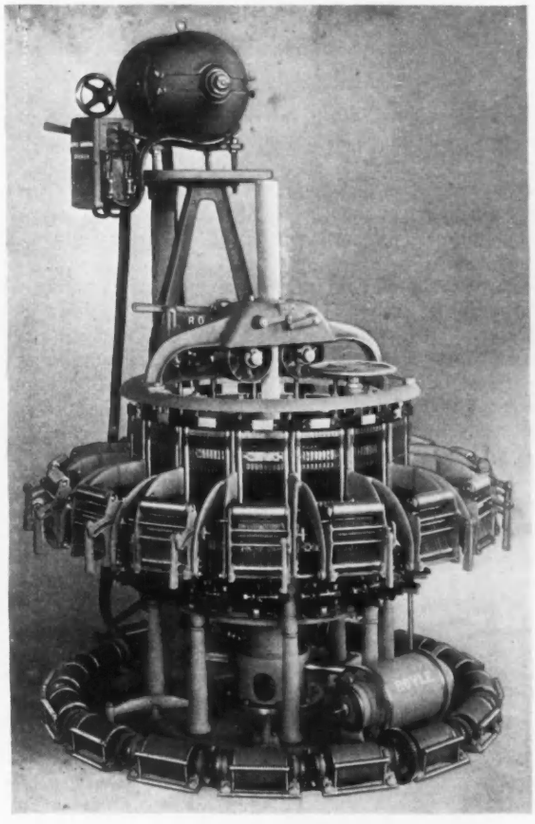


Figure 25

An adjustable speed armature shifting D. C. motor driving a circular weaving machine for making the cotton jackets that form the protective covering on fire hose

One of the most important considerations is the motor size and its mechanical construction. The application of motors to steel mill drives has been, in the past, somewhat of a cut and try proposition. It was difficult to obtain accurate data on which to base the motor size. However, this has been quite largely overcome at the present time and motor sizes have been fairly well standardized for the various types of machinery.

The motor is often operated for only a short period of time during which the period of acceleration is a large part of the cycle. Motors for this service must be capable of withstanding severe mechanical shocks, and must be designed with low inertia. The armatures are usually long and small in diameter and the mechanical parts exceedingly rugged. Motors have been developed for a number of years known as Steel Mill Type Motors, built for the service.

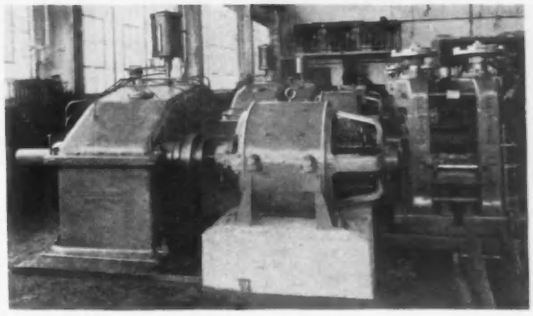


Figure 26

Three 150 hp., 400-800 r.p.m. compound wound D. C. motors driving 12-in. Bliss cold strip mills. These mills roll cold strip steel under tension in sizes of 3 inches and larger

Figure 26 shows three 150 hp., 400-800 r.p.m. compound wound D. C. motors driving 12-in. Bliss cold strip mills. These mills roll cold strip steel under tension in sizes 3-in. and up. The motors operate in the tandem and have the same speed load characteristic.

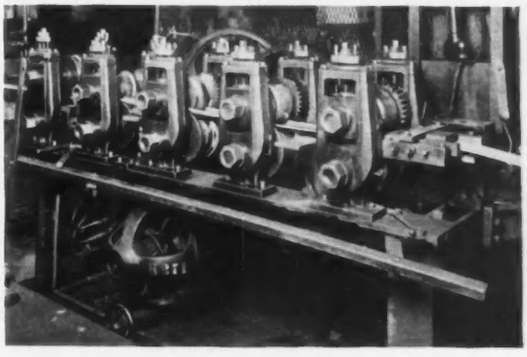


Figure 27

An adjustable speed armature shifting motor driving rolls used for forming strip stock into tubes preparatory to welding

Figure 27 shows an adjustable speed armature shifting motor driving rolls used for forming strip stock into tubes, preparatory to welding.

Figure 28 shows a compound wound direct current motor operating a draw bench, used for drawing small sized seamless tubing.

Figure 29 shows a large slow speed direct current motor such as is used for direct connection to piercing mills or reversing mills.

Crane and Hoist Applications—There are several different

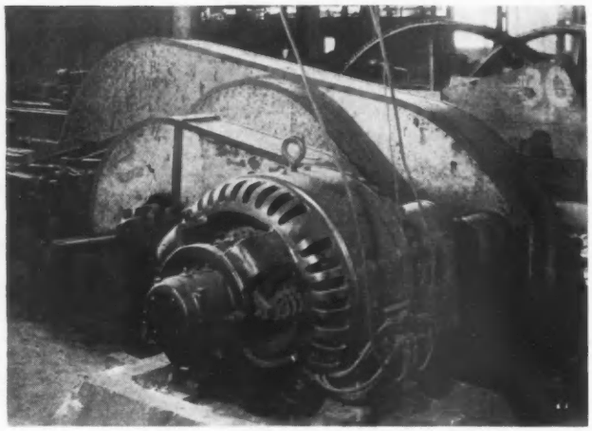


Figure 28
A compound wound direct current motor operating a draw bench used for drawing small-sized, seamless tubing

types of crane applications, but the functions of all are much the same, to hoist or lower a load, or to move it from one position to another.

It should be mentioned here that the D. C. motor operated cranes supply smooth acceleration in handling a load. Wherever accurate spotting of work and extremely careful handling of load is required as in removing molds in foundry work, D. C. motor drive is preferable.

One of the most common types is the traveling crane, which requires at least three motors, one for moving the bridge, one for moving the trolley, and the third for hoisting the load. Direct current series wound motors are considered best for this service. The series motor has a very desirable speed torque characteristic as seen in Figure 8. This characteristic is objectionable for many applications, but is quite desirable for this case. There is always a load of some sort, so that the motor is never in danger of running away. With light loads the speeds are high. With heavy loads, considerably more than normal torque can be developed for short periods of time, at relatively slow speeds.

Another very desirable feature of this application is the regenerative braking action which takes place when lowering loads, eliminating the use of a friction brake for this service. The friction brake then has only to stop the load at very slow speeds and to hold the load if desired. The life of the friction brake is thus prolonged considerably.

In addition to the series motors, a controller is required for each motor, also a limit switch and magnetic brake for the hoist motor. In some cases, overload protection is provided on a separate panel mounted apart from the main controller. In selecting the controller, there is as usual the choice between manual operation and the magnetic or automatic type. The type to select depends upon the nature of the service, number of starts, stops, etc., and considerations including first cost and maintenance. It is usually found that the magnetic type operated through a master switch is more expensive than manually operated control, but is more durable than the manual type.

The function of the limit switch is to prevent over running travel, either upwards on the hoist motor, or at the ends of the bridge for the trolley motor, or at the end of crane bridge travel for the bridge moving motor. Carelessness on the operator's part might cause serious damage in any one of these cases. This emergency switch safeguards the crane. The switch operates to open the motor circuit and short circuits the armature to provide a quick stop, by dynamic braking. This switch is always mounted far enough from the final limits of travel to insure a safe stop.

Automatic acceleration and deceleration are provided with magnetic control, but not with manually operated control. In the case of manually operated control the handling of the load depends upon the operator's skill, but usually a protection is included in the way of dynamic braking to prevent the operator from bringing a heavy load from full speed to a sudden stop.

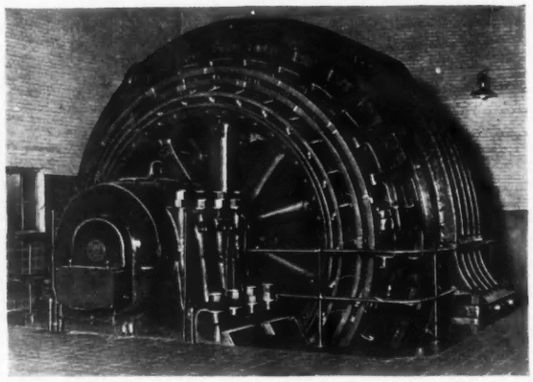


Figure 29
A large, slow speed, direct current motor such as is used for direct connection to piercing mills or reversing mills

Figure 30 shows a typical arrangement of cab and trolley for a traveling crane. The limit switch for the hoist motor can be seen at the left directly under the rails which support the cab. The lever arm projecting from the inclosed switch case trips the switch as the load approaches the limit of travel. The main distribution switch and the protective panel are shown mounted on the far side of the cab.

Figure 31 shows the cab from the opposite side.

(To be continued)

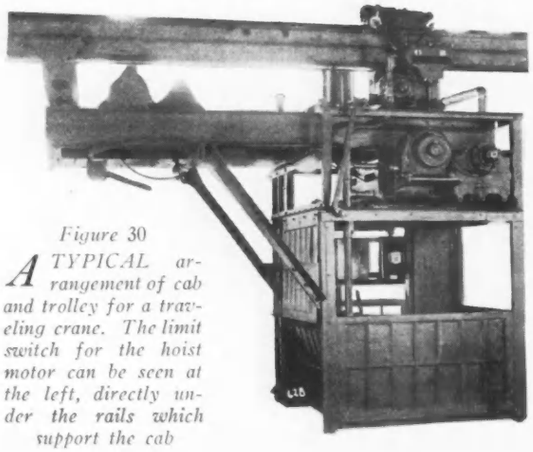


Figure 30
A TYPICAL arrangement of cab and trolley for a traveling crane. The limit switch for the hoist motor can be seen at the left, directly under the rails which support the cab

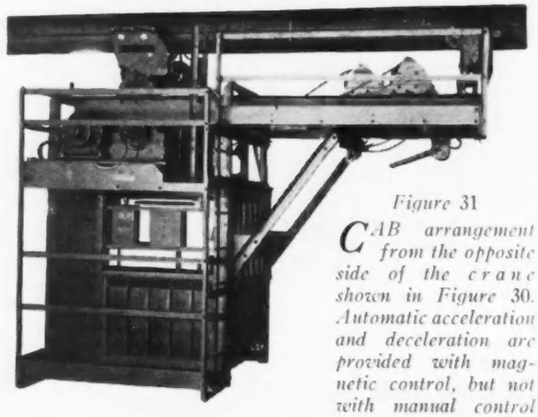


Figure 31
CAB arrangement from the opposite side of the crane shown in Figure 30. Automatic acceleration and deceleration are provided with magnetic control, but not with manual control

Asbestos – Its Uses in the Electrical Industry

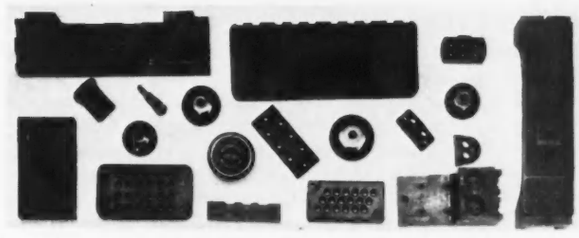
No. 17 of a Series of Articles on Common Materials

Canada continues to be the dominant producer of asbestos. Its output last year was about two-thirds of the world's total production

By William Crawford Hirsch

PROGRESS in the mechanical processes employed in the manufacture of asbestos products in recent years has quickened the interest of the electrical industry in this type of insulation. Aside from the perfectly natural reluctance of asbestos products manufacturers to go into details regarding the improved production methods that have been introduced into their plants, the real significance of this advance lies not in the modernizing of any one particular process or in the introduction of any startling innovations, but in the cumulative effect of many betterments on the properties, accuracy, appearance, and economies of asbestos products. Dollar for dollar, the buyer is getting more heat resistance and insulation, longer life, and greater uniformity in asbestos parts than ever before, this in spite of the fact that market prices for crude asbestos have undergone sharp advances in the last few years.

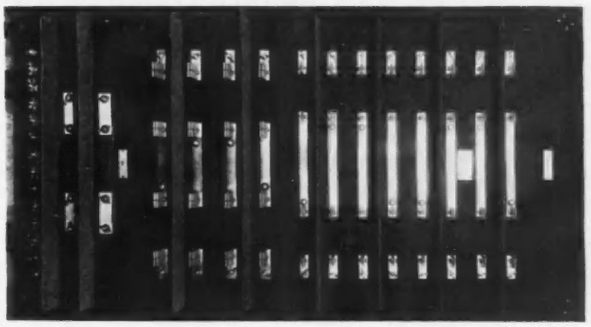
Canada continues to be the world's dominant producer of asbestos. Its output last year was about two-thirds of the world's total production which amounted to approximately 400,000 tons. The Canadian asbestos is of the chrysotile variety from which nearly all the asbestos products that enter into electrical use are made. The Canadian



This illustration shows a group of typical cold molded parts of asbestos insulating material made by the Ambler Asbestos Shingle & Sheathing Company, Ambler, Pa.

output in 1928 represented a total value of about $12,000,000. The rise in crude asbestos prices, which began to make itself felt in 1926 and became more accentuated in 1928, was due to several reasons.

Like many of the mining industries, the production of asbestos had for many years been scattered over too many small units, resulting in unhealthy competition. Mergers became the inevitable cure for the asbestos mining industry's ills, and price-cutting was gradually eliminated. Prices for the longer grades of the fibrous mineral rose, however, independently of the market's upward trend, as the result of a decrease in the Canadian production of these grades in the face of an increase in the demand. In fact, while Canada seems to be safely entrenched in the position of the world's leading asbestos producer, the Dominion output is stationary, whereas newer production fields, especially those of Africa, show a marked increase in output from year to year. Rhodesia and the Union of South Africa are turning out more and more high-grade asbestos. Cyprus, part of Britain's Empire in the Mediterranean Sea, has quadrupled its output in the last four years, and an 18-mile long aerial ropeway has been built to connect the mines at Amiandos with the seaport at Limassol. Russia's Ural deposits, estimated to contain 8,000,000 tons of

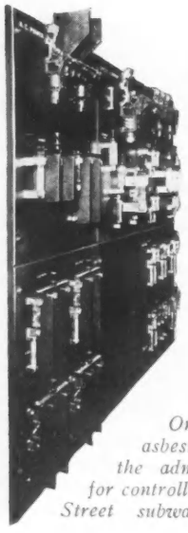


One of the 60 Ambler ebonized asbestos lumber panels used to control exhibits in the New Atlantic City Convention Hall

asbestos, are getting back into pre-war stride of production, and a wag recently said that the highly inflammable character of the intellectual exports of the Soviet Union is being more and more offset by the steadily increasing quantities of her leading non-inflammable product which are being shipped from her asbestos mines to other countries by way of Germany.

The United States produced approximately 2500 tons of asbestos last year. Arizona produces chrysotile and Alabama, Georgia, Maryland and Montana produces amphilobe asbestos. How inadequate this domestic production is may be judged from the fact that our imports last year were more than 230,000 tons, valued at approximately $9,000,000, and evidencing the fact that we are the world's largest consumers of asbestos.

These figures all pertain to crude asbestos after it has been "cobbed" or separated from the useless rock that surrounds it, and is ready for secondary manufacturing processes. Asbestos, as it comes from the mines or quar-



One of the ebonized asbestos panelboards in the administration building for controlling the North Broad Street subway in Philadelphia

ries, is a 16 to 1 affair, it being necessary to loosen about 16 tons of rock to obtain one ton of crude asbestos. This ratio, in fact, applies to fairly rich deposits, a good deal of the Canadian serpentine rock yielding only one ton of asbestos for every twenty tons mined. Worth while rock, especially that indicating the presence of long fiber, is cobbed and sorted by hand, screening serving as an auxiliary method of preparing the rock for the crusher. Compressed air is used for separating the fiber from the rock, a wet process for recovering asbestos, for which considerable economy is claimed, being still more or less on trial in some of the asbestos-producing industries.

Drying by centrifugal machines and treatment in different types of agitators follows the separation of the asbestos fiber from the rock. Methods of processing asbestos are circumscribed because of the necessity of preventing injury to and shortening of the fiber. When the long and fine fiber, for which there is demand for special uses, has been separated from the short and coarse stock, the resulting material is graded by screen test, the conventional classifications of Canadian asbestos being: Crude No. 1; Crude No. 2; spinning stocks; shingle stocks; mill board and paper stocks; filler floats, and other short fiber. The length of asbestos fiber ranges from that which can be measured only under the microscope to 4 and 4½ inches.

After the short and long fibers have been sundered, the latter are cleaned, carded, and spun into yarns. These, in turn, are woven into tape, cloth, etc., or worked up into braiding or tubing, in which form a good deal of asbestos is used as a covering for wire in uses entailing fire hazards. It is from the short fiber, however, that the principal products used in the electrical industry are made.

Among these the most important are switchboard material and molded insulation parts. So-called asbestos "lumber" or asbestos "wood" are composition sheets or boards with asbestos and hydraulic cement as the basic materials. These composition materials possess good mechanical strength and resistance to heat and fire. For that reason this type of material finds use as lining in switch boxes, in cell compartments, and wherever protection against fire and heat insulation are prime requisites. These sheets come in standard sizes of 42 by 48 and 42 by 96 inches and in thicknesses ranging from ⅛ to 2 inches. Another standard size is 48 by 96 inches which comes in thicknesses ranging from 3/16 to ½ inch. Special sizes and thicknesses are furnished to order. Manufacturers supply this material in several grades, suited for special uses, as for instance where high heat insulating value is the paramount consideration. This type of asbestos board, however, has a tendency to absorb moisture, its dielectric strength being proportionate to the moisture absorbed.

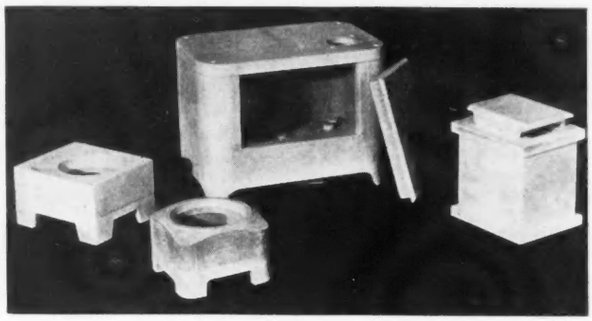
So-called "ebonized" or "ebony" asbestos "lumber" or "wood" is densely impregnated under heat and pressure with hydrocarbons which fill the open pores and impart dielectric strength, aside from making possible a fine sateen finish, very pleasing to the eye. In addition to mechanical strength and workability, this impregnated type of asbestos board offers good resistance to acids and fumes. It will not split or chip, permitting of ease in cutting, beveling, drilling, countersinking, etc.

Manufacturers suggest the use of a coping machine, such as is used for working marble, with a carborundum wheel, for accurate, quantity cutting, although an ordinary jig or band saw can be used satisfactorily. Carborundum wheels are used for beveling. Plain carbon or high-speed drills can be used at about the same speed as on cast iron or steel. A filling pitch is provided by the manufacturers. When properly applied, according to instructions, this will fuse with the asbestos board. Special lacquer for spraying is also supplied by the asbestos products manufacturers who, moreover, are prepared to do all the fabricating in their own plants.

Impregnated asbestos board is used for switchboards and bases, control panels, busbar supports, barriers, cleats, etc.

Perhaps no asbestos product furnishes more eloquent testimony to the industry's progress than the molded asbestos insulation now being offered. For many years the amalgamation of asbestos with inorganic binders proved a difficult problem. Portland cement, the earliest binder used, involved the risk of "setting" before the molding process could be completed. Research, however, in time yielded suitable molding mixtures which result in efficient products. While still characterized by molding experts as the most difficult of the various processes, the technique of cold-molding asbestos insulators has reached so high a degree of attainment that manufacturers today welcome orders for parts of intricate design, so that they can demonstrate what they are able to accomplish in this direction.

A leading manufacturer makes parts up to 400 square



Some parts of Electrobestos made by Johns-Manville which are used where resistance to deterioration by heat are essential

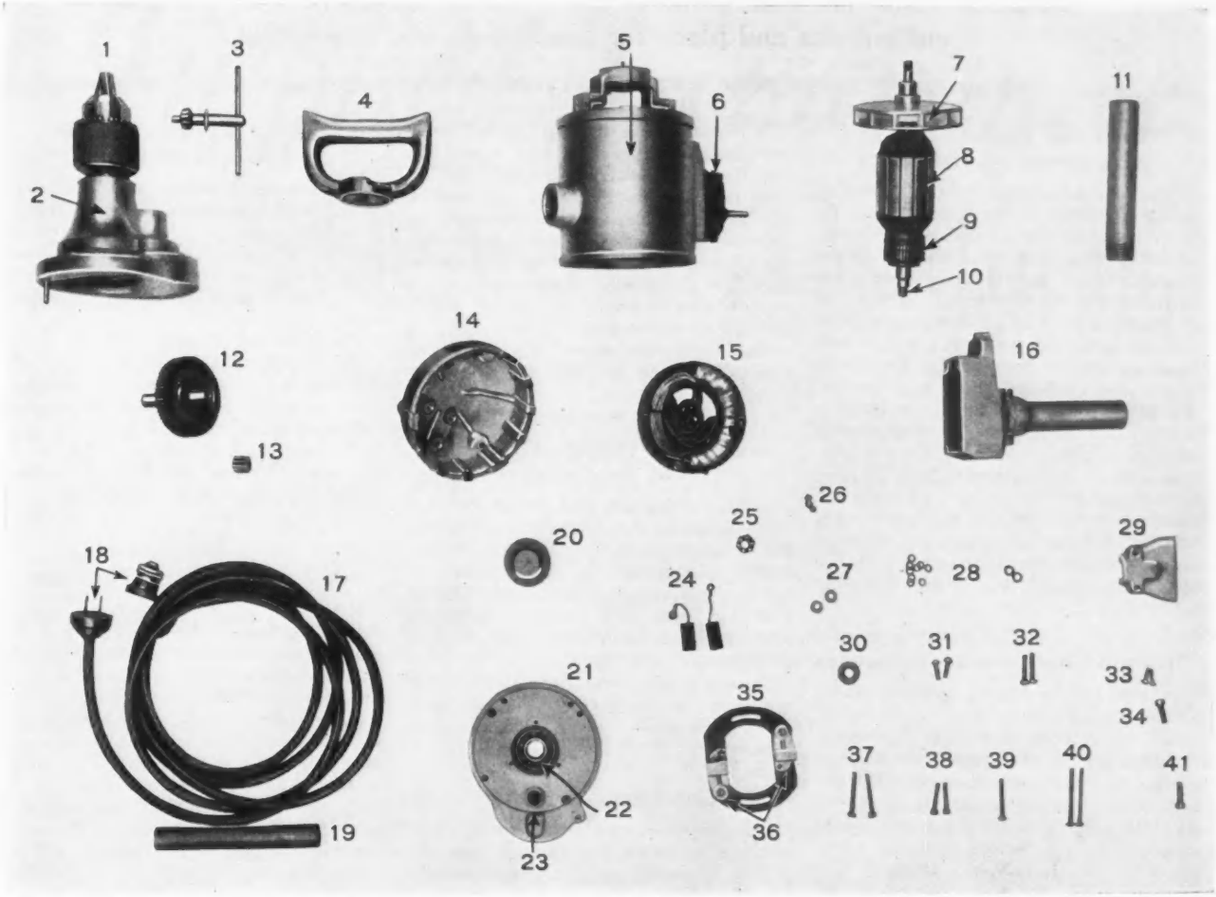
inches in surface area. When a silica lime binder is used, the resulting product is white in color. By means of impregnating with suitable compounds, this cold-molded insulation is improved in dielectric strength and non-absorption as well as other physical properties. The impregnating compounds give the insulation a black color. Cold-molded asbestos insulation is used in rheostats, motor starters, switches, fuse mountings, and innumerable other forms. It is not affected by temperatures as high as 320 deg. Fahr.

Asbestos tape is used for insulating coils where fire must be guarded against. There is woven tape and felted tape. A special type of the latter is used in combination with a super-refractory cement base as a protection against arcs in underground transmission or distribution cables. In case of a short-circuiting of one cable, the asbestos tape confines the damage to that particular conductor, preventing its spread to adjacent cables.

Asbestos paint, having a base of finely powdered asbestos, finds use as a coating for armatures and frames.

Among the not strictly electrical uses of asbestos is that in protective garments and accessories which are fashioned from it: asbestos garments, gloves, shoes, etc., and which are worn by welding and electric furnace crews.

Electric Drill Components



ELECTRICAL MANUFACTURING *acknowledges the assistance of the Hisey-Wolf Machine Company of Cincinnati, Ohio, in the preparation of the above photograph of electric drill parts and the following table of raw materials used in the manufacture of these parts. No official figures are available on the annual production of motor driven portable drills, but undoubtedly the manufacturers of these devices constitute a large market for raw materials and parts. Steel, aluminum, copper, brass, molded insulation, insulating cloth and impregnating compounds are among the leading materials used in electric drill construction*

Part No.	Title	Material	Part No.	Title	Material
1	Chuck	Steel	16	Switch handle	Aluminum alloy
2	Gear end housing	Aluminum with bronze bushings	17	Connector cord	Rubber, wire
3	Chuck key	Steel	18	Connector cord plug	Rubber, copper, steel
4	Back cap handle	Aluminum	19	Connector cord protector	Special gum rubber
5	Housing	Aluminum	20	Bearing cover	Steel
6	Switch	Copper, brass, molded rubber, fibre, etc.	21	Gear plate	Aluminum
7	Fan	Aluminum	22	Ball bearing	Steel
8	Armature	Steel, copper, wire, cotton sleeving, insulating cloth, baked bakelite	23	Bearing bushing	Bronze
9	Commutator	Copper, mica, steel	24	Brushes	Carbon, copper wire shunt
10	Armature shaft	Nickel steel	25	Bearing nut	Steel
11	Side handle	Udylited pipe	26	Bearing cover nuts	Steel
12	Pinion gear	Hardened alloy steel	27	Washers	Steel
13	Pinion	Hardened alloy steel	28	Lock washers	Steel
14	Back cap housing	Aluminum	29	Switch cover plate	Aluminum
15	Stator	Steel, copper, wire, cotton sleeving, insulating cloth, baked bakelite	30	Washer	Steel
			31-34	Screws	Steel
			35	Brush holder base	Molded bakelite
			36	Brush holder	Die casting
			37-41	Screws	Steel

Facts, Figures and Trends

Statistical information of value to electrical manufacturers in working out policies and plans for production and marketing

Fuel and Power Costs of Manufacturing Industries

The combined summary for all manufacturing industries in the United States for 1927, issued by the Bureau of the Census, gives, for the first time, separate figures on expenditures for fuel and power, which in former reports were combined with cost of materials and factory supplies. Since by far the largest portion of the fuel used in manufacturing goes into the creation of power, the combined figure for fuel and purchased power furnishes undoubtedly a better indication of power costs than would purchased power alone. Fuel and purchased power in 1927 totaled $1,897,332,370, or 5.4 per cent of the cost of materials, factory supplies, fuel and purchased power and 3.0 per cent of the total value of products manufactured, compared with 17.3 per cent for wages paid in manufacturing establishments.

Power Manufacturing Industries

In a recently published series of charts entitled "Power Manufacturing Industries, 1927," the National Industrial Conference Board shows that the Public Utility Power Plants of the country generate 60.4 per cent of their annual production of 87,851,000,000 kw-hr. by steam plants and 39.6 by water power. Of the total developed water power on Jan. 1, 1929, amounting to 13,572,000 hp., 87.6 per cent was produced by public utility and municipal plants and 12.4 per cent by manufacturing and miscellaneous enterprises. The total installed mechanical power in the United States is 39,040,563 hp.

Opportunity for Electric Light Fixtures in Colombia

Velez y Herrera Carrizona, architects, Edifico Cubillos, Bogota, Colombia, are completing plans for a modern apartment building to be constructed in Bogota in the near future, and they are desirous of securing quotations from American manufacturers of electric light fixtures, according to Department of Commerce "Electrical Foreign Trade Notes."

All quotations should be c.i.f. Puerto Colombia, and, if possible, credit from 120 to 180 days should be extended. The bank reference is the Royal Bank of Canada, Bogota and New York. The Bureau, of course, assumes no responsibility for any transactions which may occur.

Increased Use of Electricity in Netherlands

During the year 1928, 211,000,000 kw-hr. were sold by the electric company in Amsterdam as compared with 188,000,000 kw-hr. in 1927, an increase of 12 per cent. The increasing use of electricity for household purposes is in the main responsible for the higher output. In fact, for the first time the amount of current used in the homes was greater than that used for other lighting purposes, excluding the electricity used for street lighting. The amount used for household purposes advanced from 42,200,000 kw-hr. in 1927 to 50,600,000 in 1928, an increase of 20 per cent; the current used for power increased from 60,600,000 kw-hr. in 1927 to 68,200,000 in 1928.

Increase in Danish Production of Insulators

Danish production and export of electrical porcelain devices, chiefly insulators, has increased rapidly during the past year, and it appears that the export especially has met with considerable success. During 1927 the export of porcelain insulators from Denmark amounted to only 311 tons as compared with 736 tons during 1928. Some of the chief consumers of this product were Spain, Norway, Sweden, Germany, Portugal, Poland, Belgium and Switzerland.

Conditions in Chile

The general economic situation in Chile continues to be very satisfactory, and the outlook is promising. The growing shortage of labor is forcing wage scales steadily upward. Large construction activities, good crops at better prices, and the foreign demand for and high prices of copper, all contribute to increased merchandise sales. Money conditions showed a further tightening. Bank discount rates for commercial paper have been further increased one-half to three-fourths per cent.

Utility Investments Increasing

At the beginning of 1929 the light and power industry had 23,582,000 customers of all classes—domestic, commercial and rural. The value of physical plant and equipment was $10,000,000,000—an investment of $424 for every customer. The investment required for each customer is gradually increasing as the service is extended to smaller towns and farms.

Electrically Heated Stereotype Pots

More newspapers of today are employing the electrically heated stereotype pots that have been growing in use since 1925. At present, 73 publishing companies in this country have installed 121 electrically heated pots, ranging from three-fourths of a ton to nine tons in size, with a total of approximately 12,000 kilowatts in electric capacity.

Danish Vacuum Cleaner Has a Good Year

The recently published annual statement of the Danish company Fisker & Nielsen, large producers of the vacuum cleaner "Nilfisk," indicated that the last year brought very excellent results to the company, both in point of turnover and earnings.

The earnings of the past year aggregated 728,000 crowns, and a 12 per cent dividend was paid to the share holders. After payment of dividend amortization and depreciation, etc., 400,000 crowns were transferred to the reserve fund, which thus reached a total of 12,000,000 crowns, and 67,000 crowns were transferred to the next year's account.

A Large Electric Furnace

Milwaukee claims to have the biggest electric furnace in the world. It is big enough to accommodate a standard box car with ease, and is three times as large as any previously built.

It uses 1,400,000 kw-hr. of electricity per month—enough to light 35,000 average homes. It will heat 400,000 pounds of metal at a time to a maximum temperature of 1650 deg. Fahr. Walls of insulating material two feet thick surround the oven, confining the heat to the furnace.

European Center for Purchase of Radio Equipment

An International Exhibition for Radio and Talking Machines and Equipment has been announced to be held in Freiburg, Switzerland, from Sept. 7 to 15, 1929. The purposes of the exhbition are: To create in Europe an international center for the purchase and exchange of apparatus and material appertaining to the fields of radio and talking machines; to promote international economic relations and to find markets for both types of products; to increase interest in radio and phonographs, and to assist exhibitors in attracting the favorable attention of buyers.

Approximately 9,000,000 Homes With Radio Sets

New York State leads in the number of homes with radio sets, according to a recent estimate of *Broadcast Advertising*, with 1,149,120 homes enjoying the advantages of this modern invention. Pennsylvania is the second State in point of total sets, with 738,000, followed by Illinois with 698,220 and then by California with 646,650. The total homes with radio sets in this country on Jan. 1, 1929, has been estimated at 9,000,000, as compared with 7,500,300 one year ago.

The Legal Aspect of *Implied Guarantees* on Electrical Products

There are two classes of guarantees recognized legally, expressed and implied, and the uses of these are discussed in the accompanying article

By Leo T. Parker

WARRANTIES are legally classified as expressed and implied. An expressed guarantee exists under circumstances where the buyer and seller orally or in writing agree to the exact terms of the warranty. An implied guarantee is one in which the seller does not make a warranty, but the circumstances are such that a court implies that a warranty exists irrespective of the contrary contentions of the seller.

In other words, the character of a contract or the intended uses of electrical equipment is frequently such that a purchaser is compelled to rely upon the honesty of the seller to supply equipment reasonably fit for the intended purposes. Under these circumstances the courts imply a warranty on the part of the seller that he will supply a device having quality reasonably good in consideration of the price paid.

Generally speaking, a buyer who is successful in a litigation involving an implied guarantee is required to introduce convincing testimony to prove that the equipment positively failed to render reasonably good service as may have been expected by other prudent users.

On the other hand, the outcome of a litigation involving an expressed guarantee depends entirely upon the court's interpretation of the original intentions of the parties at the time the contract was completed.

Also, it is well established that the usual laws relating to ordinary contracts are applicable in deciding a controversy involving an expressed guarantee, whereas since an implied warranty never is agreed upon by the parties to a contract, it is not a contractual obligation, but a common law right invokable by the buyer under conditions consistent with the present legal policy adapted by various courts that "right is might."

Moreover, although electrical equipment is adapted for a general purpose, the seller is liable for an implied guarantee that it will perform a special service if he knows the purchaser intends to use it for this special purpose.

For example, in A— Company vs. K— & T—, 150 N. W. 12, it was disclosed that an electric company agreed to install an electric generator with accessories in a theater. The theater owner refused to pay for the equipment on the contention that its capacity was not sufficient to supply light for the theater and also supply current to operate its lights and machinery for displaying motion pictures.

The seller filed suit to collect the amount due, but the theater owner introduced testimony to prove that the seller knew the intended uses of the equipment. In view of this evidence the court held the theater owner not required to pay for the equipment, saying:

"If he (the purchaser) goes to a manufacturer or dealer describing the kind of work to be done or the result he desires to accomplish, and such manufacturer or dealer professes to be able to supply an engine or machinery which will do it, and the buyer is thereby induced to give him an order therefor, then there is an implied warranty that the machine or thing so furnished is reasonably adapted to the work for which it is procured, even though the order particularly defines and describes it."

On the other hand, a manufacturer is not liable for an implied guarantee that electrical apparatus shall be suitable for a particular purpose, unless the seller is fully informed of the circumstances upon which the buyer later bases his contention of his rights to an implied guarantee.

Moreover, if the contract of sale contains an express guarantee which the seller fulfills, the courts are likely to render a verdict in favor of the seller.

The leading case involving this point of the law is the United States case of A— vs. G— Company, 210 F. 775. Here it was disclosed that the owners of an office building

MR. PARKER is an attorney at law and counsellor of the United States Circuit Court of Appeals for the Sixth Circuit, and is well qualified to discuss the legality of contracts. In what he says here he indicates clearly that there are many ramifications to contracts for electrical equipment in which there may be either implied or expressed guarantees.—The Editor.

contracted with the electric company to have an electric power and lighting plant installed in their building for the stipulated price of $13,472. The contract contained a written guarantee, which read as follows:

"The company guarantees that the generator connected therewith will run continuously at its normal rated capacity without undue heating, undue noise or vibration."

The purchaser attempted to avoid paying for the equipment upon the grounds that the electrical apparatus was unfit for the purpose of furnishing light and power in that particular building because the generator at its normal rated capacity caused the building to vibrate and thereby rendered the building undesirable to renters.

The electric company contended that since the apparatus complied with the written guarantee they were not liable for an implied warranty that the generator would be suitable for operation in that particular building.

The court held the owners of the office building liable for the full purchase price of $13,472, of the equipment, stating important law on the subject, as follows:

"In the first place the contract in question, as we read it, is essentially a contract for the manufacture and sale of the articles therein specified and described, and it is well settled that such a contract carries no warranty by implication. This principle has been long established. . . . Where a known, described and defined article is ordered of a manufacturer, although it is stated to be required by the purchaser for a particular purpose, still, if the known, defined, and described thing be actually supplied, there is no warranty that it shall answer the particular purpose intended by the buyer. . . . The written agreement of the parties contains a definite guarantee regarding certain machines included in the apparatus purchased, and that guarantee measures and limits the plaintiff's (electric company's) obligation in the respect here considered. For these reasons, it must be held that there was no implied warranty that the machinery in question would be suitable for the uses of the building in which it was to be installed. . . . Whilst an implied warranty that an article will be fit for a particular purpose may be inferred in a contract to make or furnish it to accomplish that purpose, yet no such warranty arises out of a contract to make or supply a specific, described, or defined article, although the manufacturer or dealer knows that the buyer buys it to accomplish a specific purpose, because the essence of this contract is the furnishing of the specific article, and not the acomplishment of the purpose. . . ."

Oral Contracts are Equally as Effective as Written Contracts and Both are Governed by Practically the Same Laws

IT is important to know that an oral contract is equally as effective as a written one and both are governed by practically the same rules of law. The important difference between a written and an oral contract is that the complaining party must introduce evidence to prove the contents of an oral contract, whereas the courts construe a written contract strictly in accordance with the intended meaning of the written words. Moreover, verbal promises or agreements have absolutely no effect to vary the meaning of a written contract unless it is shown that such verbal promises were made to fraudulently induce the other party to enter into the contract.

Many litigations have been instituted by persons who do not know that the courts will not permit the introduction of verbal testimony simply to vary the meaning of a valid written contract. These persons invariably lose the suit. In fact, the only circumstances under which testimony of verbal statements may be introduced for the purpose of relieving the complaining party from the obligations of fufilling a written contract is for him to prove fraud, an unavoidable mistake, or to explain the meaning of ambiguous parts of the agreement.

For example, in the leading case of O— Company vs. W—M— Light & Power Company, 155 N. W. 112, it was disclosed that the president of a corporation engaged in the manufacture and sale of electric vacuum cleaners demonstrated to the manager of an electric company a model of the vacuum cleaner. Afterward the manager signed a written contract of sale for a quantity of the sweepers, with the oral understanding that he should have the privilege of returning the sweepers if they are not satisfactory.

An Important Part of the Law is that a Purchaser of Electrical Apparatus May Spend Money to Repair It

ABOUT two months after the sweepers had been shipped, the buyer notified the seller that the cleaners did not operate satisfactorily, and soon thereafter reshipped them to the seller. The latter refused to accept the cleaners and filed suit against the buyer to recover the purchase price.

It is interesting to observe that the court held the buyer bound to pay for the sweepers because he had lost his legal rights to rely upon an implied guarantee, since he had delayed too long in returning the merchandise. Also, the court held the seller not responsible for the oral agreement to take back the sweepers, saying:

"The rule is that, in the absence of fraud and mistake, parol evidence of antecedent or contemporaneous verbal agreement of the parties to a written contract is unadmissible to contradict, alter, or modify the written contract. . . . The retention of articles purchased is as effectual an acceptance of them as if the purchaser intimates to the seller that they are accepted."

Another important point of the law is that a purchaser of electrical apparatus not adapted to give reasonable satisfaction, may expend necessary money to repair it and the seller is liable for the amount. Moreover, although the condition of the device is improved but still it does not render reasonably satisfactory service for the intended purposes, the purchaser is entitled to damages in addition to the money he expended for repairs.

For example, in H— vs. F—, 7 S. W. (2d) 313, decided during the past few weeks, it was disclosed that an electrical machine failed to operate properly and used too much electric current. The buyer proceeded, without knowledge of the seller to expend $75 in repairing it. After expending this amount, it was worth $450 less than its purchase price. The seller sued to recover the full amount of the contract price contending that since he had not expressly guaranteed that article to the buyer, he should have returned it instead of expending money on it.

However, the lower court held the purchaser entitled to deduct $525 from the purchase price and the higher court sustained this descision, in effect saying:

"It appeared that these defects might be remedied at a reasonable cost, and the purchaser had the right to affirm the sale and to recoup the expenses incurred when sued for the balance of the purchase money. . . . But if, notwithstanding the expense the defect is not completely remedied . . . the purchaser may recoup the difference between the value of the article and its contract price, together with the expense."

However, the legal effect of an implied warranty is destroyed by a written or verbal agreement between the buyer and seller in which it is clearly understood that the seller does not impliedly guarantee his product.

For instance, in I— Company vs. B—, 169 S. W. 549, the contract after distinctly specifying an expressed guarantee, stated:

"This express warranty excludes all implied warranties."

(*Continued on page* 70)

What's NEMA Doing?

A department covering activities of the divisions, committees and sections of the National Electrical Manufacturers Association

New Nema Divisional Arrangement Indicates Flexibility and Coordination

The new divisional set-up of the National Electrical Manufacturers Association demonstrates a high degree of flexibility and coordination in association management. It is designed chiefly to assist and coordinate Section activities.

The following outline gives the Sections affiliated with each of the ten Nema divisions:

Insulating Material Division—electrical porcelain, laminated phenolic products, manufactured electrical mica, molded insulation, vulcanized fiber.

Appliance Division—carbon arc lamp, electric range and water heating, fan motor, heating appliance.

Radio Division—power supply, receiver, transmitter, vacuum tube.

Refrigeration Division—domestic refrigeration, commercial refrigeration.

Transmission and Primary Distribution Division—high voltage insulator, switchgear, transformer.

Utilization and Control Division—air circuit breaker, carbon, electric measuring instrument, industrial control, mining and industrial locomotive, motor generator, panelboard and distribution board, signalling apparatus, storage battery.

Wiring Devices Division—attachment plug, fuse, knife and enclosed switch, lamp receptacle and socket, snap switch.

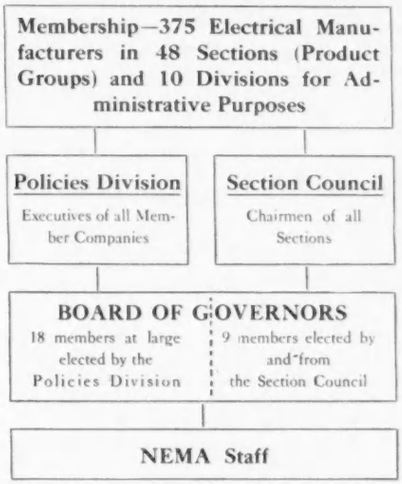
Wiring Materials Division—armored conductor and metallic flexible conduit, conduit fittings, electrical porcelain, metal molding, non-metallic conduit, non-metallic sheathed cable, outlet box and switch box, rigid conduit, wire and cable.

Industrial Heating Division—electric welding, melting furnace oven, resistance type furnace.

Lighting Division—commercial lighting, exterior lighting, electric sign, industrial lighting, street lighting.

Overhead Trolley Line Materials Section (not affiliated with any division).

NEMA Organization Diagram


Membership—375 Electrical Manufacturers in 48 Sections (Product Groups) and 10 Divisions for Administrative Purposes
Policies Division
Executives of all Member Companies
Section Council
Chairmen of all Sections
BOARD OF GOVERNORS
18 members at large elected by the Policies Division
9 members elected by and from the Section Council
NEMA Staff

Nema Engineer Discusses Code Development

At a recent meeting of International Association of Electrical Inspectors, Eastern Section, W. J. Canada, Nema engineer, discussed the importance of the National Electrical Code and its relation to safety and economical production and installation of wiring materials.

He discussed the growth of the N. E. Code and the functions of the Nema code committee. He pointed out the benefits to be derived from a uniform code used nationally.

Transformer Section Effects Committee Changes

The transformer section at its meeting at Hot Spring on May 20 and 21 appointed G. A. Sawin, Westinghouse Electric and Manufacturing Company, chairman of the business policy committee, succeeding H. W. Smith, who resigned.

A committee consisting of M. F. Mitschrich Moloney Electric Company, chairman; A. C. Farmer, Westinghouse Electric and Manufacturing Company; R. C. Sogge, General Electric Company, and J. A. Johnson, Kuhlman Electric Company, was appointed to consider the standardization of accessories for distribution transformers.

The section is considering the collection of statistics and has appointed a committee consisting of A. C. Farmer, Westinghouse Electric and Manufacturing Company, chairman; L. C. Nichols, Allis-Chalmers Manufacturing Company, and L. R. Brown, General Electric Company, to review the matter with Nema headquarters and to report results to the section.

Molded Insulation Section Conducts Second Session

Twelve member and six non-member companies were represented at the second meeting of the Molded Insulation Section, Nema which was held July 16, at the Sylvan Estates Country Club, near Jackson, Mich. One of the features of the session was an expertly conducted tour of the plant of the Reynolds Spring Company.

During the business meeting a committee was designated to study the adoption of a trade name for molded insulation. A resolution was adopted to gather statistics on the losses of tools if any, during the past two years. Another resolution authorized the gathering of data effecting standard cost accounting. Figures presented at the meeting showed that for the first quarter of 1929 twenty molders, less than one-third of the country's total, did business totaling $3,038,012.

Sections Adopt Equalization of Traveling Expenses

A number of sections, in an effort to improve attendance at meetings, have adopted a method of equalization of traveling expenses, and in the sections in which this is in force, a very material improvement has been shown in the attendance.

The total round trip mileage is figured for each member company of the section from New York City to the company's home office. The total number of miles obtained is multiplied by five cents a mile and the result divided by the number of members in the section. The result represents the charge to each company.

When the funds are collected, each member located more than twenty-five miles from New York is rebated at the rate of five cents per mile. Members not attending the meetings are charged pro rata, but do not receive a rebate and only one representative from each company is figured on this basis.

Notices of meetings with tentative programs will hereafter be sent to members.

Screen Grid Radio Receiver Clearly Defined

As a result of a formal request made by the National Better Business Bureau to Louis B. F. Raycroft, vice-president of the National Electrical Manufacturers Association, a definition of "screen grid radio receivers" has been worked out for the use of the former organization in maintaining watch on unethical or misleading advertising.

In order to assure a uniform stand by the entire radio industry R. H. Manson, chairman of the Nema Radio Engineering Council, and W. E. Holland, director of the engineering division of the Radio Manufacturers Association, cooperated with Mr. Raycroft in formulating the following tentative definition:

"A radio receiver designed to utilize not less than two screen grid tubes in tuned radio frequency circuits may be properly classified as a screen grid receiver."

Industrial Control Standards

These standards for industrial control apparatus include American Standards, Nema Adopted Standards, Recommended Practices and Suggested Standards for future Design. The use of them results in greater uniformity and in improved quality of industrial control equipment

THE following article is the fifth and last in a series presenting the Industrial Control Standards of the National Electrical Manufacturers Association. This series forms a reference work of practical information concerning the manufacture, test and performance of industrial control equipment

120-751 Abbreviations (*continued*)

Calibrating	Cal.
Circuit Closing	Cir. Cl.
Circuit Opening	Cir. Op.
Concentric	Conc.
Control	Cont.
Current	Cur.
Curve Drawing	Crv. Drg.
Definite Time	Def. T.
Differential	Diff.
Direct Current	D. C.
Directional	Dir.
Discharge	Disch.
Disconnecting	Disc.
Equalizer	Eq.
Expulsion	Exp.
Float	Fl.
Governor	Gov.
Graphic	Graph.
Induction	Ind.
Instantaneous	Inst.
Insulating or Insulation	Ins.
Inverse Time	Inv. T.
Limit	Lim.
Oil	Oil
Operating	Opr.
Overload	O. L.
Poles and Throws	
Single Pole Single Throw Switch	S P S T Sw.
Single Pole Double Throw Switch	S P D T Sw.
Double Pole Double Throw Switch	2 P D T Sw.
Four Pole Double Throw Switch	4 P D T Sw.
etc.,	etc
Potential	Pot.
Power	Pwr.
Pull	Pull
Push	Push
Recording	Rec.
Series (descriptive)	Ser.
Series (used alone)	Series
Shunt (descriptive)	Sh.
Shunt (used alone)	Shunt
Starting	Stg.
Synchronism	Syn.
Synchronizing	Syn.
Synchronous	Syn.
Under Voltage	U. Volt.
Voltage	Volt.

Recommended Practice 6-13-1923.
Recommended Practice 10-21-1924.

Specifications

Specifications for D. C. Contactor Type Controller for General Purpose Traveling Cranes

General

120-801 (a) The control equipment shall conform to the standard rules of the National Electrical Manufacturers Association and the American Institute of Electrical Engineers.

(b) The requisite contactors shall be provided for the basic functions of the controller, such as stopping, reversing, and for the specified number and character of speed control points.

(c) The control equipment shall consist of the necessary master switches, contactor panels, resistors, and protective devices to meet the requirements of Rules 120-401 to 120-409 inclusive.

Recommended Practice 11-17-1920.

Resistor Mounting

120-802 (a) The resistor units shall be mounted in substantial end frames, and provided with terminals for connection to the control panel. Where the resistors are furnished for separate mounting, the wiring thereto is not to be included.

Recommended Practice 11-17-1920.

Master Switch

120-803 (a) The master switch shall be of the enclosed type and shall have renewable contacts and terminals for external connections.

(b) The master switch for hoist control shall provide for not less than four points of speed control in each direction of operation for motors larger than 25 hp.

(c) The master switch for bridge and trolley travel controllers shall provide for not less than three points of speed control in each direction of operation except under any of the following conditions, where not less than four points shall be supplied:

(1) Where the full speed exceeds 150 ft. per minute.

(2) Where cars are to be dragged along the floor.

(3) Where the rails are unusually slippery or uneven, and only one-half of the wheels are driven by motors.

Recommended Practice 11-17-1920.

Controller Functions

120-804 (a) The hoist controller shall provide for dynamic braking control in the lowering direction.

(b) Low (or under) voltage protection shall be provided for each motor, either as a function of each controller or by a protective panel.

(c) Overload protection shall be provided for each motor, either as a function of each controller or by a protective panel. When it is on the protective panel, it shall include either two single pole or one double pole contactor, arranged for opening both sides of the line; and there shall be one overload relay in one side of the main line, and one overload relay for each motor circuit in the opposite side of the line.

Recommended Practice 11-17-1920.

Contactor Capacity

120-805 (a) The continuous capacity of the main line contactors on the protective panel shall be not less than 50 per cent of the combined one-half hour rating of the motors, nor less than 75 per cent of the one-half rating of the largest individual motor.

Recommended Practice 11-17-1920.

Disconnecting Means

120-806 (a) A double pole line switch with provision for locking in the open position shall be provided, either on each controller or on the protective panel. When mounted on the protective panel,

Standards Index for This Page

120-751 Abbreviations (continued)

Specifications for D.C. Contactor Type Controller for General Purpose Traveling Cranes

120-801 General
120-802 Resistor Mounting
120-803 Master Switch
120-804 Controller Functions
120-805 Contactor Capacity
120-806 Disconnecting Means

it shall have a carrying capacity not less than that specified above for the main line contactors.

Recommended Practice 11-17-1920.

Fuses in Control Circuit

120-807 (a) The control circuit system shall be protected by at least one fuse in each side of the line.

Recommended Practice 11-17-1920.

Additional Protective Panel Requirements

120-809 (a) Where a protective panel is provided as part of the control equipment of the crane there shall be provided:

(1) Two lamp receptacles on the protective panel fused and connected to the line wires outside of the line switch. These receptacles shall be connected in series; and, where necessary, a resistor shall be provided in this circuit so that 50-watt 115-volt lamps may be used.

NOTE I—Two lamps may be used in these receptacles, or one lamp and one plug for a lamp cord, so that a working light may be had, with the line switch open.

(2) A safety and reset station shall be provided for opening and closing the line contactors of the protective panel.

Recommended Practice 11-17-1920.

Magnet Brakes

120-810 (a) A magnet brake shall be furnished for the hoist motor of sufficient size to hold at least the rated full load torque of the motor when the magnet coil is disconnected.

Recommended Practice 11-17-1920.

Hoist Limit Switch

120-811 (a) Where a hoist limit switch is required on the crane, it shall be arranged to stop the motor before the hoist reaches its upper limit of travel, irrespective of a failure of voltage or position of the controller. The limit switch may be connected in the motor circuit directly, or a limit switch in the control circuit may be used, in which case an extra trolley wire will be provided by the customer for the control circuit.

Recommended Practice 11-17-1920.

NOTE I—It is preferable to have the limit switch connected directly in the motor circuit and operated by the block.

Specifications for Building Equipment Control Apparatus

Introduction

120-820 (a) The requirements for motor control equipment in buildings, such as office buildings, theatres, schools, hotels, etc., involve special considerations of safety, of compactness of arrangement and convenience of operation, accessibility and location.

Standards Index for This Page

120-806 Disconnecting Means (Continued)
120-807 Fuses in Control Circuit
120-809 Additional Protective Panel Requirements
120-810 Magnet Brakes
120-811 Hoist Limit Switch
Specifications for Building Equipment Control Apparatus
120-820 Introduction
120-821 Scope
120-822 General
120-823 Enclosures
120-824 Overload Protection

(b) Architects and Consulting Engineers, in recognizing this, have been careful to specify the features that such control equipment must possess, and the experience of many years has brought about a unanimity of opinion as to the fundamental requirements.

(c) The Controller Manufacturers associated in the Apparatus Division of NEMA present these Specifications for Building Equipment Control Apparatus as a summary of the best modern practice as indicated by architects and engineers of wide experience. Adherence to these requirements will permit of the simplification of controller manufacture, improved service, economies in installation, protection to the users and other advantages of standardized practice.

Scope

120-821 (a) Building equipment control apparatus is defined as control for motors, driving fans, blowers, pumps, compressors, refrigeration ice machines, etc., installed in office buildings, theatres, hotels, apartment houses, and the like. Typical specifications of the apparatus are given in 120-831.

(b) These specifications do not cover control for motors, running elevators or fire pumps.

General

120-822 (a) Controllers shall conform to the National Electrical Code, the National Electrical Safety Code and to the Industrial Control Standards of NEMA. If provisions of State or municipal codes supplement the above, the manufacturer shall be informed by the purchaser.

(b) The following points with particular reference to control apparatus are covered by the National Electrical Code:

CIRCUIT BREAKERS
- Where they may be used.
- When they may be used as the disconnecting switch.
- Capacity relative to motor rating.
- Setting of overload trip coil.
- Number of overload trip coils.
- One pole in each conductor.
- All poles must be opened simultaneously.
- Temperature rise.
- Spacing within an enclosure.
- Tests for insulation and arc rupturing.

FUSES
- Where they are required.
- Where they may be used.
- Rated capacity relative to motor rating.
- One in each conductor.
- May be shunted while starting a squirrel cage motor.
- Construction and dimensions.

SWITCHES
- Where they are required.
- Where they may be omitted.
- Rated capacity.
- Disconnect all wires of the circuit.
- Marking.
- Indicate position.
- Construction.

RHEOSTATS
- Lead wire insulation.
- When dust-proof enclosure is required.
- Low-voltage release required D.C. starters.
- Spacing of live parts.

TERMINALS
- Soldering lugs above 30 amperes.
- Clamps with upturned lugs up to 30 amperes.

The following points, with particular reference to control apparatus, are covered by NEMA Standards.

GENERAL
- Nomenclature.
- Basis of rating.
- Overload protection of motors.
- Under or low voltage release or protection.
- Service classification of resistors.
- Starting currents.

TEMPERATURE RISE PERMISSIBLE
- On resistor.
- On contactors.
- Coils.
- On busbars.

CONSTRUCTION DETAILS
- Range of operating voltages of contactors.
- Enclosures.
- Insulation distances.
- What are acceptable as non-corrodible materials.
- Standard resistors for general purpose motors.
- Terminal markings.

Some municipalities, notably Chicago, and some States, as California and Wisconsin, have codes which require certain features not generally called for. It is, therefore, necessary to specify what local rules apply to the apparatus in question.

Enclosures

120-823 (a) In general, open type apparatus is permitted when it is under competent supervision, installed where it is accessible only to qualified authorized persons and where the voltage to ground is less than 300 volts. Where accessible to other than qualified persons, the apparatus should be of the enclosed type. It is, therefore, necessary to specify whether the controller is to be the enclosed or open type.

(b) Provision shall be made for providing a lock to enclosures. The locking means may be a hasp to receive a padlock, unless otherwise specified.

Overload Protection

120-824 (a) Above 5 hp., 115 volts, or above 10 hp. at the higher voltages, overload protection shall be provided by time limit circuit breakers of the equivalent, such as contactors with overload relays. Fuses or thermal cutouts may be employed for protection of smaller motors.

(b) The overload protection devices shall be mounted on the controller ex-

cept where they form a naturally integral part of the separately furnished disconnecting means.

Mounting

120-825 (a) The supporting frame of the controller shall be arranged for floor or wall mounting as specified by the purchaser.

(b) If the location of the controller requires a certain mounting arrangement, it should be specified, otherwise manufacturers' standard will be furnished.

Classification of Controllers

120-826 (a) Purchaser shall specify:

I—Supply

1. Direct current or alternating current.
2. Voltage.

(And if alternating current):

3. Three-phase, two-phase or single-phase, 3-wire or 4-wire for three-phase and two-phase.
4. Frequency.

II—Control (one of the following):

1. Manual, starting duty.
2. Manual, regulating duty.
3. Automatic, starting duty.
4. Semi-magnetic, speed-setting, regulating duty.
5. Full-magnetic speed, indicating, regulating duty.

III—Speed Regulation

1. Armature resistor (D. C.).
2. Field resistor (D. C.).
3. Rotor resistor (A. C.).
4. Pole changing (A. C.).
5. Brush shifting (A. C.).

120-827 (a) It frequently becomes desirable to combine, for the purpose of pump control, two controllers in a single unit for a single motor, or for two motors. Where such is the case, classification of the apparatus becomes as follows:

I—Single Motors.

1. Dual manual.
2. Dual automatic.
3. Dual manual and automatic.

II—Two Motors.

1. Duplex manual.
2. Duplex automatic.
3. Duplex manual and automatic.

A. (1) *Dual Manual.*
Consists of two manually operated starters mounted on a common panel with a transfer switch, which may be employed to connect the motor to either of the two starters at will.

A. (2) *Dual Automatic.*
Consists of two automatically operated starters mounted on a common panel with a transfer switch, which may be employed to connect the motor to the two starters at will.

A. (3) *Dual Manual and Automatic.*
Consists of one automatic starter and one manual starter mounted on a common panel with a transfer switch. The motor may be operated at will by either the manual starter or the automatic starter through the control of a suitable pilot device.

B. (1) *Duplex Manual.*
Consists of a manual starter for each motor and a transfer switch which, in one position, will provide connections for operating motor No. 1 and starter No. 2, and motor No. 2 and starter No. 1, and in the other position shall provide connections for operating motor No. 2 with starter No. 2 and motor No. 1 with starter No. 1.

B. (2) *Duplex Automatic.*

a—Consists of two magnetic starters, one double pole pilot transfer switch, and one pilot control device. This arrangement contemplates that one motor and one magnetic controller will be used as a spare or emergency equipment. The pilot transfer device shall therefore provide, in one position, for connecting the pilot device to function with controller No. 1 and motor No. 1, and in the other position to function with controller No. 2 and motor No. 2.

b—Consists of two automatic starters, one pilot circuit transfer switch and two pilot control devices. It is contemplated that the two pilot control devices may have different adjustments so that one takes care of a normal demand while the other operates only when there is an abnormal demand. The connections shall be such that with the transfer switch in one position, the pilot device No. 1 will operate with starter No. 1 and motor No. 1 and pilot No. 2 will operate with starter No. 2 and motor No. 2. In the other position pilot No. 2 will operate with starter No. 1 and motor No. 1 and pilot No. 1 will operate with starter No. 2 and motor No. 2.

B. (3) *Duplex Manual and Automatic.*
Consists of one automatic starter, one manual starter and one transfer switch. With the transfer switch in one position, motor No. 1 may be operated by the manual starter and motor No. 2 by the automatic starter under the control of the pilot switch, while in the other position, motor No. 1 may be operated by the automatic starter under the control of the pilot device and motor No. 2 may be controlled by the manual starter.

Standards Index for This Page

120-825 Mounting
120-826 Classification of Controllers
120-827 Pump Control
120-828 Tryout Switch
120-829 Pilot Control Devices
120-830 Speed Indication Remote Control Station
120-831 Typical Specifications

Tryout Switch

120-828 (a) With each automatic and speed-setting control panel shall be provided a tryout switch, by means of which the starter may be operated independently of the pilot control device.

Pilot Control Devices

120-829 (a) One of the following pilot control devices, as specified by purchaser, shall be furnished with each automatic starter or magnetic controller.

a. *Float Switch.*
Float switch shall be single pole, enclosed type, with quick break feature, together with suitable float and operating mechanism.

b. *Vacuum Regulator.*
Vacuum regulators shall be single pole, enclosed type, with quick break feature.

c. *Pressure Regulator.*
Pressure regulators shall be single pole, enclosed type, with quick break feature.

NOTE—A relay in combination with a slow moving regulator affords the equivalent of quick break.

d. *Push Button Master Switch.*
Push button master switch shall be of the enclosed type and each button shall be marked to indicate its function. The switch case shall provide for conduit wiring.

Speed Indication Remote Control Station

120-830 (a) With each full magnetic speed indicating controller shall be furnished a remote control station adapted for starting and stopping the motor, for adjusting the speed, and for indicating the relative speed attained.

Typical Specifications

120-831 (a) The following form of specifications is recommended for use by architects, engineers and others who have occasion to write specifications for building equipment control apparatus:

a. *General.*
Control for (motor rating and service application) shall conform to the specifications of NEMA for building equipment and control apparatus.

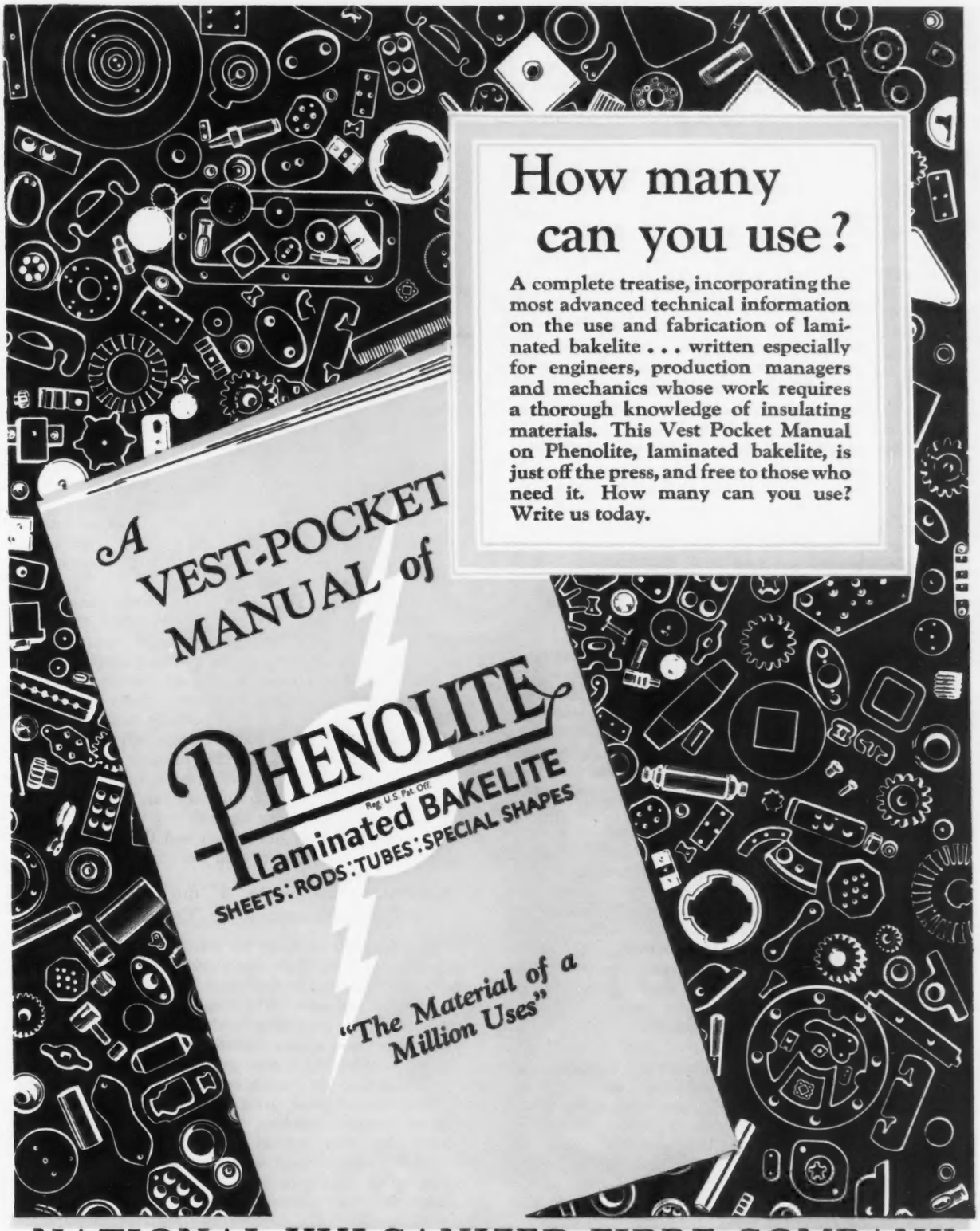
b. *Supply.*
Supply will be:
.....volts D. C.
.....volts A. C.....phase
.....wire .....cycle

c. *Operation.*
Control shall be (specify type desired from the following list).
Manual, starting duty.
Manual, regulating duty.
Automatic, starting duty.
Semi-magnetic, speed-setting, regulating duty.
Full magnetic, speed-indicating regulating duty.

d. *Regulation.*
(Omit this paragraph if constant speed motor is used). Speed regulation shall be accomplished by: (select method desired from the following list).
Armature resistor (D. C.).
Field resistor (D. C.).
Rotor resistor (A. C.).
Pole changing (A. C.).
Brush shifting (A. C.).

e. *Inclosure.*

(*Continued on page 82*)



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Electrical Instruments for Aircraft

A discussion of the requirements for electrical instruments in aircraft as an aid in their construction

Continued from page 33

eral, all protective coatings should be so chosen that a possible crack or scratch cannot be the seat of an electrolytic reaction. Instruments should be hermetically sealed whenever possible.

Size—The tendency in all aeronautic instrument work is toward standardization. The army and navy have issued specifications on which all of their instruments are purchased. According to these, altimeters, airspeed indicators and tachometers must have a 2 3/4-in. dial and four mounting lugs of definite size and position. Fuel and oil pressure gages, and distant reading thermometers must have a 1 7/8-inch dial. These specifications may be obtained from either the Bureau of Aeronautics, U. S. Navy Department, Washington, D. C., or Material Division, Army Air Corps, Dayton, Ohio. Although these specifications apply only in the purchase of instruments for the Services they are being adopted by manufacturers generally and any departure from them will soon meet resistance, even in the purely commercial field.

Scale Arrangement and Magnetic Shielding are Two Important Functions

SCALE ARRANGEMENTS—In the quick comparison of instrument readings a series of adjacent vertical scale instruments offers a decided advantage. This is particularly true in the case of multi-engined planes where it is essential to set the three engines to the same speed. Tachometers for this purpose would be easily read if they had identical vertical scales, mounted side by side. In spite of this apparent advantage the tendency seems to be definitely toward round dial instruments. The present operators seem to be interested in being able to read an instrument with equal absolute accuracy over the entire range from when the plane lies idle in the hangar to when it is being run at full speed. These requirements of a uniform open scale of a definite size practically demand that such indicators as tachometers, airspeed indicators, and altimeters should have an allowable pointer motion of approximately 300 degrees. The electrical instruments which are now commercially available with such a pointer motion are of foreign origin. The rotation of the pointer beyond 90 deg. has been accomplished by two distinct methods: by gearing up the motion of the pointer shaft in a 90 deg. instrument, and by using a novel magnetic circuit so that the current carrying coil in the instrument actually moves through 300 deg. The time may come when a suppressed zero instrument, i.e. for example, a tachometer with a scale to be read only between 1600 and 2000 r.p.m. will give the operator all of the necessary information. Until then the electrical instrument manufacturer must furnish a 300 degree instrument if he is to compete seriously with the existing non-electrical types.

Magnetic Shielding—At present there is some opposition to the use of electrical instruments if for no other reason than that they may set up magnetic fields and so affect compass readings. Those who have experienced such difficulties will probably demand that the instrument be so magnetically shielded that the compass will be unaffected when the instrument under consideration is either inserted or removed from its position on the instrument panel. With the increased use of distant indicating compasses, such as the earth inductor, this trouble will be minimized as it will then be possible to place the direction sensitive element of the compass at an appreciable distance from the instruments to be read. Such a universal adoption of the distant indicating compass is decidedly improbable until its reliability has been increased and its price decreased.

Instrument Markets—Leaving out of consideration the military services, out of whose appropriations the present aeronautic instrument industry has been so largely built up, the manufacturer has three possible outlets for his products.

Transport planes will become more and more dependent upon electrical systems of communicating intelligence from various parts of the plane's structure to the pilot. Mechanical connections between engines and instrument panels are giving trouble in the present multi-engined planes and the situation is liable to become worse as the distance between these elements is increased in larger planes. These planes will demand the best and most reliable equipment procurable, almost without regard to cost.

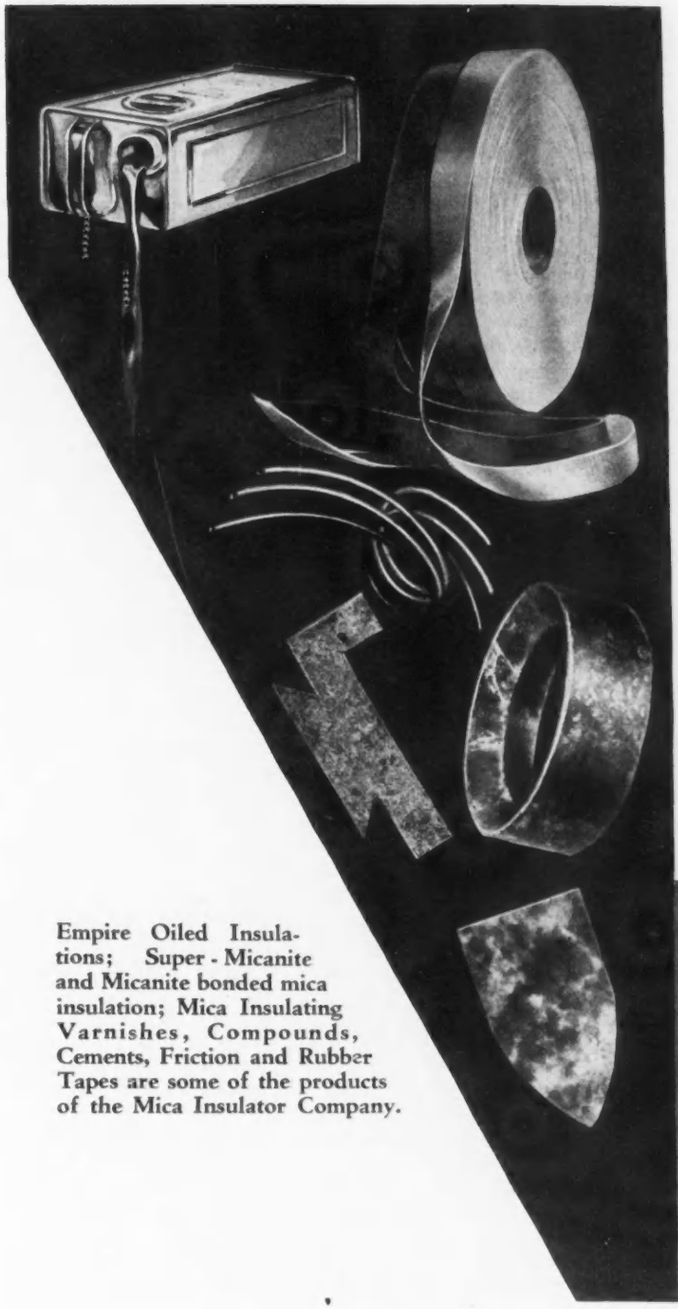
As the general price of engines and planes declines and places them in a class available to individual owners, a market will be created for instruments in which price is of importance. These light planes, probably single-engined, will not demand the great variety of instruments to be carried by the larger transport planes. Some instruments which will be carried will be absolutely essential to the safety of this individual means of transportation and should never be built cheap at a sacrifice of their serviceability. Any of our automobiles, past or present, could be run indefinitely under all conditions of weather, without instruments and without resulting harm to any of the occupants. This cannot be said of our planes and there seems to be little probability that it ever will be.

High-Grade Instruments of the Most Exacting Types Necessary for Test Flying

THE third type of flying for which instruments must be built is that of flight test work. Here the demand is likely to be small and concentrated with a few large plane manufacturers and users. The demand, however, will be for instruments of the greatest possible accuracy. In this field, there is, at present, a keen demand for some universal type of distant recorder which does not require any photographic processes. All of the variables encountered in flight test work, such as air-speed, pressure, temperature, r.p.m. and strain on various members are readily convertible into variations in either current or voltage which could be recorded at a central point with a suitable instrument. This recorder might readily be mounted on a spring suspension to shield it from vibration and shocks, and might be thermally insulated and kept at any required temperature during a run. It should, however, function in any position, deliver a continuous record which can be read without any further equipment, and be capable of recording with a lag of less than one second, variations in current of the order of 50 microamperes, or variations in voltage of the order of 5 millivolts.

Many engineers have long since decided why some of this apparatus cannot be delivered. Perhaps someone with a more flexible mind can solve the problems.

Helpful Facts *about electrical insulation*



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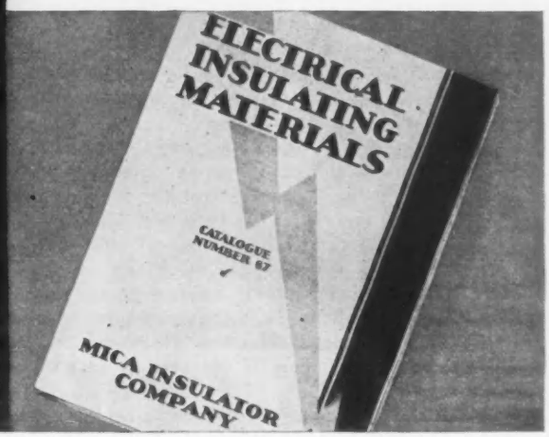

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Standardization Aids the Electrical Industry

(*Continued from page 25*)

requiring standard coupling and braking systems for railroads and uniform braking and gear shift controls for automobiles have been welcomed as a national asset promoting the safety of the general public. In the preparation of standards designated as "Codes," the present tendency to resort to details or to prescribe specific construction methods detracts materially from their merits. Standards of this character should preferably contain no mandatory provisions and be limited to general recommendations if they would be of practical value. The administration of mandatory codes by local authorities inevitably leads to conflict and losses through inability to take advantage of improved methods not recognized in a prevailing code standard.

The advantages derived from simplification and elimination of waste in any undertaking should be too well known to require enumeration at this time. The manufacture of munitions during the late war furnished an outstanding example of the advantages derived from simplified manufacturing processes in developing volume production. Standardization of business procedure and processes has not infrequently restored a failing business to prosperity. The success of the Pullman Company has been built upon standardized construction and service methods.

With all that has been done in our own industry, many important projects require further study and possible standardization. Rating standards, switching apparatus, high tension insulator design and performance, lightning, protective equipment, distribution systems and their allied devices, cable insulation, insulating oils, appliance performance, service regulations, and motor rules are all projects warranting continuous efforts toward complete standardization. The cost of prosecuting this work is high involving the time and efforts of hundreds of individuals supplementing annual expenditures variously estimated at from $8,000,000 to $10,000,000.

Standards may be nothing to enthuse over, yet there is a considerable measure of satisfaction in viewing past accomplishments in the standardization field. It is apparent on every hand that this work has already contributed materially to the welfare of the manufacturer and the ultimate consumer in such liberal measure as to warrant recommendations for continued support and prosecution of standardizing activities on behalf of the electrical industry.

Implied Guarantees on Electrical Products

(*Continued from page 62*)

The court held that this clause prevents the buyer from relying upon the law that a seller implied a warranty in addition to the expressed guarantee.

In still another case, D— Mfg. Company vs. M—, 101 N. W. 903, the language construed as excluding the implied warranty was: "It is understood the goods are warranted only against breakage caused by manifest defects."

Yet, the mere fact that a contract of sale contains an expressed guarantee does not destroy the implied guarantee, unless it is clearly understood that such is the intentions of the parties.

For illustration, in R— Company vs. S— Company, 83 S. E. 138, it was disclosed that a company engaged in transmitting electrical power ordered from another company, engaged in the business of manufacturing wire for electrical transmission, certain copper wire. The written contract specified the diameter of the wire and contained a guarantee clause, which reads as follows:

"We guarantee the wire not to vary in gauge over one per cent above or below diameters given, and to have conductivity of not less than 97 per cent of that of pure copper."

It was also stated that the acceptance of this proposition constituted a purchase of the material and bound the company to deliver the same. Underneath this provision, the purchaser signed his name.

When the purchaser received the material he refused to pay for it contending that the wire broke readily and was unfit for the purpose for which it was intended.

The seller contended that he was not liable for an implied guarantee as he had fully complied with the expressed guarantee.

However, the court held the seller liable to the purchaser under an implied warranty that the wire be so constructed as to be properly adapted for use in transmitting electricity and free from latent defects, explaining the law on the subject in the following language:

"Under such a contract specifying the diameter of the wire and its conductivity, there was no implied warranty that it would accomplish all that was expected of it or intended by the purchaser, but there was an implied warranty that it was properly constructed copper wire of the size and kind specified, and reasonably suited for use as such. . . . In the absence of an express warranty it places upon the purchaser the duty of using caution in detecting defects; but it declares that in all cases (unless expressly or from the nature of the transaction excepted) there is a warranty declared by law to be implied in the respects mentioned. . . . If a contract expressly declares that there shall be no other warranties than those expressed, no difficulty can arise. . . . Where the express contract covers or supersedes the implied warranty of the law, it excludes the latter; but where the two are in conflict, and the parties have not undertaken by the express warranty to cover the whole subject matter of the sale and of the warranties which the law itself implies, they are not excluded, except so far as the express warranty deals with the subject matter of the implied warranty. . . . We are not contending that terms can be added to a written contract by parol testimony, but that where the parties make a written contract the law may make certain implications in regard to the subject matter, and that one of the things which it implies in a sale of personalty is a warranty of certain things, unless that warranty is expressed by reason of the terms of the contract itself or by reason of the nature of the transaction. This is an implication which the law itself imposes, except under the circumstances mentioned; and it is an entirely different matter from endeavoring to super-add to a written contract parol agreements."

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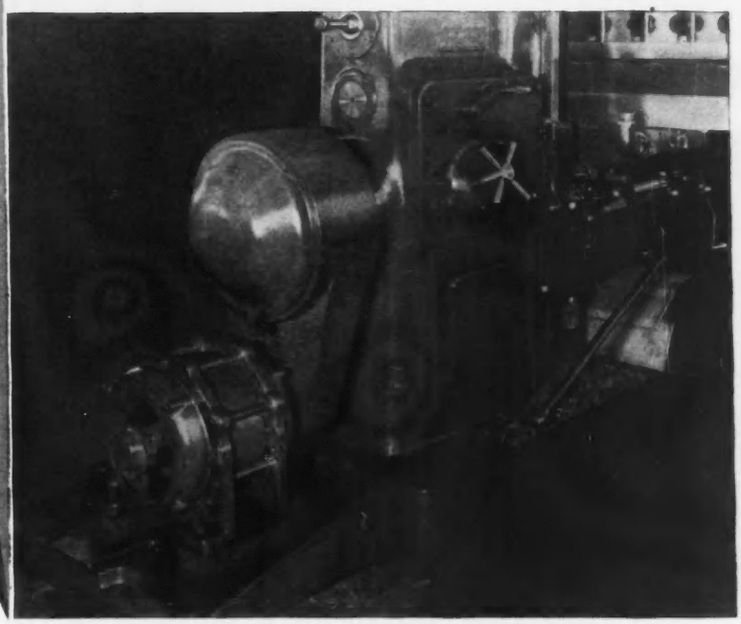

NEW DEPARTURE

1268

BALL BEARINGS

NOTHING ROLLS LIKE A BALL

Electrical Manufacturing News

A department containing news, and descriptions of new materials, parts and devices for the manufacture and repair of electrical products

Cooperative Agreement Reached by Standards Bodies

A cooperative agreement between the American Standards Association and the U. S. Bureau of Standards, which will encourage national standardization activities in all industries, was ratified recently by George K. Burgess, director of the Bureau of Standards and by the board of directors of the American Standards Association.

The board also considered the invitation extended to the American Standards Association to join with the national standardizing bodies of fourteen European countries in the International Standards Association, which has its headquarters at Baden, Switzerland. It was decided, however, that this matter should be held over for consideration at the next meeting of the board, to permit further study of the methods by which the American Standards Association could cooperate with the foreign bodies. The board also resolved to launch an extensive national campaign to finance industrial standardization activities on a basis merited by the tremendous savings which these activities are securing for American industry. A finance committee, consisting of Bancroft Gherardi, chairman, Quincy Bent and Howard Coonley, was appointed to head this effort.

Under the terms of the agreement with the Bureau of Standards, the primary effort of the bureau will be to serve those industrial groups which have no satisfactory standardization facilities of their own. The bureau will help these groups to formulate temporary standards designed to meet immediate requirements. The American Standards Association will work primarily with those bodies having standardization facilities and will bring together such groups for the formulation of "American Standards" which represent a true national consensus of approval. Where feasible, temporary standards prepared with the aid of the Bureau of Standards will also be brought before the American Standards Association for advancement to the rank of "American Standards."

The American Standards Association is a national federation of forty government, technical and trade associations, and includes the U. S. Department of Commerce, of which the Bureau of Standards is a division, in its membership.

Committee Appointed to Study Educational Broadcasting

Declaring that "This conference may have more important results than we now realize," Secretary Wilbur of the Department of the Interior, brought to a close recently an informal meeting held in Washington to discuss the possibilities of education by radio. A committee headed by U. S. Commissioner of Education William John Cooper has been named to make a thorough, authoritative study of the entire subject.

The purpose of this new "Advisory Committee on Education by Radio," as it is officially called, is simple yet comprehensive. Secretary Wilbur speaks of it in these terms: "The possibilities of radio as an educational tool appeals to educators, broadcasters, manufacturers, and the public at large. This general interest has led to the appointment of a committee to make a thorough fact-finding study of the situation."

The whole radio industry, says the Department of the Interior, is profoundly interested, with the committee, in the subject of educational broadcasting. It recognizes that such broadcasting is still largely experimental. It believes that its possibilities are great. It realizes that all the efforts of the industry so far have succeeded in reaching but 11,000,000 of the 27,800,000 homes in this country—that nearly three-fifths of the potential market is still undeveloped. More important still, it knows that such an alliance, once well organized and well carried on, with all the organized forces of education, would lift radio to a position of tremendous power and importance among national industries.

For many reasons, therefore, continues the statement, the entire radio industry may be expected to cooperate enthusiastically with the Advisory Committee in its efforts to make of this subject a study which will be in the highest degree complete, authoritative, sound, and useful.

June Electrical Exports Rise Above Last Year's Level

Electrical apparatus exported from the United States during June, 1929, according to the Bureau of Foreign and Domestic Commerce of the U. S. Department of Commerce, totaled $11,672,425, as compared with $9,254,855 for June, 1928. A substantial increase of electrical exports for the first six months of 1929 over the corresponding period of 1928 is shown. The totals are $70,788,339 and $54,266,866, respectively.

The largest single item of export listed for June, 1929, is refrigeration sets up to one-quarter ton capacity, the total being $1,118,531. For the first six months of this year, total value of this item is $5,274,034. Next in order of value are radio receiving sets, $539,547 for June, 1929, as compared with $228,983 for June, 1928; first six months of 1929 and 1928, $3,015,552 and $1,300,134, respectively. Insulated copper wire and cable stand next in order of value, the totals being $538,290 for June, 1929; $484,206 for June, 1928; $3,392,393 for first six months of 1929; $2,311,459 for first six months of 1928.

Canada was the chief destination for U. S. electrical exports during June, 1929. A total of $3,196,437 of electrical apparatus went to that country. Argentina was next in importance, total value of goods shipped, $1,047,237. The largest single item imported into the United States during June, 1929, was miniature carbon filaments for incandescent lamps, total number imported, 5,728,525; total value, $136,108. These were imported from Japan.

New York Electrical Show Plans Progress Rapidly

Electrical appliances and equipment of every description, that plays a significant part in the progress of the electrical world, will have an important place in the first National Electrical Exposition, which will be held in Grand Central Palace, New York, from October 7 to 12 The exposition is under the auspices of the Electric Board of Trade of New York and the New York Electrical League. Since the announcement of the exposition a few weeks ago, a constant flow of inquiries has been forthcoming, and much of the space allotted for the display has already been sold.

The display will be exceedingly comprehensive in scope. It is designed to attract both the industrial user and the domestic consumer of electric current. Nothing but electrical equipment will be featured, and in order that the exhibits may be viewed to the best advantage, the hours from 10 a. m. to 2 p. m. are to be restricted to the admission of industrial and commercial users only. From 2 p. m. to closing the general public will have the same opportunity for comparison and selection among the electrical achievements of the day. Plans for the arrangement of the exhibits are being made from the viewpoint of convenience to these two important groups.

The show committee of the first National Electrical Exposition is as follows: Theodore H. Joseph, chairman, E-J Electric Installation Company; S. E. Kimball, Kimball Electric Company; W. B. DeForest, Graybar Electric Company; Harry A. Hanft, electrical contractor; W. B. Pierce, Edison Electric Appliance Company; Hugo Tollner, Tollner Electric Company; W. S. McClure, New York Edison Company, and Earl Whitehorne, president, Electrical Board of Trade of N. Y., and New York Electrical League. Fred W. Payne and Charles F. Roth are co-managers of the exposition.

Colored Television Shown by Bell Laboratories

Television in color was demonstrated recently by the Bell Television Laboratories, New York City. The arrangement consisted of a wire hookup across a room between transmitter and receiver. Through a small peek hole were clearly perceiv-

Balanced Values

Of the major qualities which, summed up, represent the measurable value of a die casting, the invisible one of SERVICE ranks foremost in the minds of most buyers. The value of NEWTON SERVICE becomes manifest on short acquaintance. It balances the quality value which has been responsible for the still growing preference for this Company's product.

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able the colors which were passed before the transmitter.

The Bell Laboratories, it was said, are concentrating on the development of television by wire, rather than by radio. Experts believe that the application of television as an accessory to regular telephone service is entirely feasible and would prove commercially successful.

Summer Sales Are at Peak, Says R. M. A. President

Summer sales of radio products and also production are now at their peak according to President H. B. Richmond of the Radio Manufacturers Association in discussing the meeting of the R. M. A. board of directors, held Aug. 8 at the Clifton Hotel, Niagara Falls, Ontario. Many national radio problems, especially those relating to the manufacturer, were discussed by the R. M. A. board of directors with plans for expansion of service to the radio public and to members of the Association.

"Summer sales of radio products are excellent," said President Richmond. "Many of our manufacturers report that summer business this year is as good or better than last summer despite the fact that there was the extraordinary stimulus to sales last year of the political campaign. Better broadcasting, including unique hot weather novelties developed by the broadcasters, together with better performing receiving sets, are undoubted reasons for the wider summer use and enjoyment of radio.

New products, new models with the substantial improvements made by the industry, have been made available to the public and placed on the market sooner this year. Virtually all of the new radio products shown at the R. M A. Trade Show at Chicago this year are now on the market, in some cases about sixty days sooner than in past years. Many of our manufacturers have greatly increased their production schedules. A mid-summer survey gives every indication of an excellent radio year, with better radio programs, better broadcasting, and better products with more value per dollar to the radio purchaser than ever before."

Light's Golden Jubilee Body Includes Prominent Names

The following well-known men and women have accepted membership on the general committee in charge of Light's Golden Jubilee, the worldwide celebration of the fiftieth anniversary of Thomas A. Edison's incandescent lamp:

Herbert Hoover, honorary chairman; Miss Jane Addams, James R. Angell, Gen. William Wallace Atterbury, Gen. Robert Lee Bullard, Dr. Nicholas Murray Butler, Rev. S. Parkes Cadman, Newcomb Carlton, Walter P. Chrysler, Paul D. Cravath, P. E. Crowley, John W. Davis, Gen. Charles G. Dawes, George Eastman, Harvey S. Firestone, Hon. John S. Fisher, Dr. Simon Flexner, Henry Ford, Rev. Harry Emerson Fosdick, James W. Gerard, W. S. Gifford, Miss Virginia Gildersleeve, Hon. Fred W. Green, William Green, Will H. Hays, Dr. John Grier Hibben, A. B. Houghton, Roy W. Howard, Charles Evans Hughes, Otto Kahn, Hon. Morgan F. Larson, Clarence H. Mackay, Dr. Charles Horace Mayo, Dr. William James Mayo, Hon. Andrew W. Mellon, Hon. Dwight W. Morrow, Prof. E. L. Nichols, Frank B. Noyes, Dr. Henry F. Osborn, Gen. John J. Pershing, Dr. Michael F. Pupin, Fred W. Ramsey, A. W. Robertson, H. M. Robinson, John D. Rockefeller, Jr., Julius Rosenwald, Charles M. Schwab, Mrs. John F. Sippel, Dr. Samuel Wesley Stratton, B. E. Sunny, Paul M. Warburg, Daniel Willard, Dr. Stephen S. Wise, Owen D. Young.

New Conduit Fittings Company Headed by J. C. Boyton

J. C. Boyton, for fifteen years general manager of the Adapti Company, Cleveland, Ohio, is now president of the Adalet Manufacturing Company, 4610 St. Clair Ave., Cleveland, Ohio. This new organization will manufacture a complete line of conduit fittings, which will include body boxes, box connectors, boxes and covers, entrance service caps, conduit boxes, pipe fittings, junction boxes, service entrance fittings, service and pipe clamps and marine fittings.

The Adalet Manufacturing Company has announced a policy which emphasizes cooperation with wholesalers and protection to them in the sales of their products. An engineering department will be at the disposal of conduit users.

Erie Malleable Iron Alters Territorial Management

Erie Malleable Iron Company, Kondu Division, Erie, Pa., announces the following changes in its territorial divisions:

The Cleveland branch is no longer a central divisional office but is now a district office operating under the jurisdiction of Pittsburgh. H. B. Schreck is now manager of the Cleveland office, with headquarters in the Leader Building. In addition to Cleveland, the Toledo, Cincinnati and Columbus offices also come under the territory of Pittsburgh. C. B. Small manages the Pittsburgh office.

The Philadelphia office, located in the Widener Building, is in charge of H. N. Stark, and operates under direction of the New York office. E. J. Hunter is district manager at New York. The Boston office, also under direction of New York is located at 1 Court St., Boston, in charge of W. P. Dudley.

Detroit is now under the jurisdiction of the Chicago office. Lee Marion is Detroit manager with offices at 423 Curtis Building, Detroit.

Bull Dog Electric Eliminates Unapproved Products

The discontinuance of electrical products which do not conform to the National Electrical Safety Code of the U. S. Bureau of Standards, has been announced by the Bull Dog Electric Products Company, Detrot. In line with this policy the company will no longer manufacture the following:

Live face or open type lighting panelboards, lighting panelboards having main fuses (not switched) or fusible only subfeeds on the panels, feeder or distributing panelboards having fuses only in the branches (not switched).

Moe Brothers Organize Fixture Manufacturing Organization

Moe Brothers Manufacturing Company is the name of a new Milwaukee corporaton recently organized by Henrik Moe and O. E. Moe for the manufacture of lighting equipment and kindred products. Until recently Henrik Moe, president of the new concern, and O. E. Moe, vice-president in charge of sales, occupied the same positions with the Moe-Bridges Company, Milwaukee.

The new corporation will manufacture modern lighting equipment for national distribution. According to Henrik Moe, the policy will be to meet particularly the modern needs of the average American home and the commercial lighting field. The company will also design and manufacture special lighting equipment for the more pretentious homes and public buildings. A completely equipped experimental department will be maintained for developing new ideas and keeping the line in the van of progress.

Scranton Button Takes Over Two Record Manufacturers

Scranton Button Company, Scranton, Pa., manufacturer of molded products, has taken over and merged the Regal Record Company and Cameo Record Corporation, both New York phonograph record manufacturers. The consolidation involves $8,000,000 and is to be known as the American Record Company. Louis Sylvester, president of the Scranton Button Company, will also head the new firm.

Long Established Firms Form Jointly-Owned Subsidiary

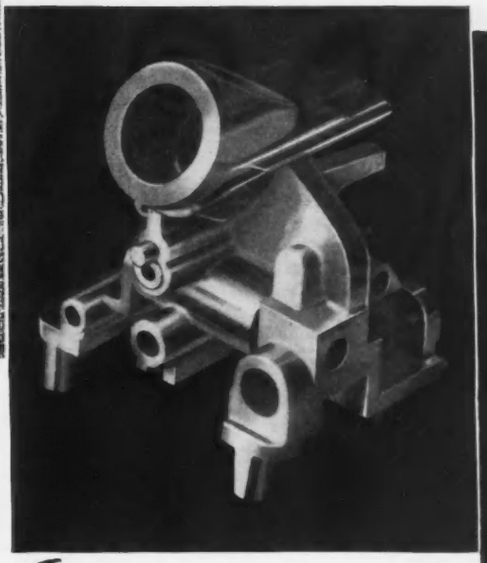
The New York Wire Cloth Company, of New York City and York, Pa., and the Celluloid Corporation, of Newark, N. J., announce the formation of a jointly owned subsidiary corporation, The Vitalite Company. This new firm is engaged in the manufacture and sale of a fine wire cloth coated with a cellulose acetate composition. The resultant product is a flexible wire glass, possessing the advantages of weather resistance and of transmitting the ultraviolet rays of the sun.

The officers of The Vitalite Company are: L. D. Root, president; W. S. Landes, vice-president; A. E. Cameron, secretary and treasurer. Mr. Root is the treasurer of the New York Wire Cloth Company; Mr. Landes is vice-president in charge of manufacture for the Celluloid Corporation, and Mr. Cameron is secretary of the Celluloid Corporation. The directors of The Vitalite Company are L. D. Root, Robert P. Turner A. E. Cameron and John A. Stephens who is president of the Celluloid Corporation.

Distributors on Deck for Camp Refrigeration Third

Camp Refrigeration Third, the annual conference of the General Electric Refrigeration Department, will be held this year August 28 to August 31 at Association Island, Henderson Harbor, N. Y.

An unusually complicated piece accurately and economically produced by Stewart Die Casting Process.



Production reduced to its simplest form

Die Cast by Stewart

Many complicated parts which would not be economically possible with other methods of production are delivered in quantity accurately, and at moderate cost, by Stewart Die Casting Service.

Stewart Die Castings produce as a single unit what would otherwise be a complicated assembly, maintain close tolerances in routine production, give smooth finish, adequate strength, light weight, and many other detail advantages.

The Stewart engineering staff offers practical information on the advantages of the die casting process as applied to any individual manufacturing requirements.

Stewart

THE STEWART DIE CASTING CORPORATION

4500 Fullerton Avenue CHICAGO, ILLINOIS

Detroit - Pittsburgh - Dayton - St. Louis - Newark - Cleveland

EM 8-Gray

Approximately 275 distributors, guests and members of the General Electric Company will be in attendance. Business sessions will be held from 9 a. m. to 1 p. m. with P. B. Zimmerman, sales manager of the refrigeration department, acting as chairman.

Brevities

Time - O - Stat Controls Company, manufacturer of automatic controls, with general offices and factory at Elkhart, Ind., recently opened a New York sales office at 11 W. Forty-Second Street. This office will be the headquarters for all salesmen contacting Eastern and Atlantic Coast states manufacturers. A number of sales engineers and service men will be stationed in this new branch. Carl W. Scholle is in charge.

Allen-Bradley Company, Milwaukee, Wis., manufacturer of electric controlling equipment, has appointed as district representative in the Western Michigan territory, F. L. Reynolds. His headquarters will be in Grand Rapids, Mich.

Ambler Asbestos Shingle & Sheathing Company is the new name for the Asbestos Shingle Slate & Sheathing Company, Ambler, Pa.

Electric Heater Corporation is the new name for the Acorn Heater Corporation, State and Bostwick Avenues, Bridgeport, Conn. The company states that the name was changed because of a confusion resulting from a similarity between the established Acorn trade mark and that of another manufacturer. There has been no change in the company's policy, personnel or in the construction of the instantaneous electric heaters.

National Carbon Company, New York City, announces the appointment of Delbert E. Replogle as sales engineer for the Product Development Division. Mr. Replogle was formerly associated with the Raytheon Manufacturing Company, radio tube manufacturer, recently acquired by National Carbon. He is a graduate of the Massachusetts Institute of Technology and at the present time is chairman of the television committee of the Radio Manufacturers Association.

Zenith Radio Corporation, Chicago, Ill., recently completed a new plant adding more than 250,000 sq. ft. to the company's manufacturing facilities. The new plant houses the cabinet factory where more than a quarter of a million dollars worth of modern woodworking machinery has been installed.

Porter - Cable Machine Company, Salina and Wolf Streets, Syracuse, N. Y., has purchased and will continue to manufacture the Emmert oscillating spindle sander formerly made by the Emmert Manufacturing Company, Waynesboro, Pa.

Timken Roller Bearing Company has appointed as assistant secretary and assistant treasurer, R. C. Brower, formerly general manager of the Timken Roller Bearing & Sales Company, Canton, Ohio. W. H. Richardson, formerly New York branch manager for the latter company, has been appointed general manager. E. H. Austin, manager of the Kansas City branch, has been named New York manager.

Westinghouse Electric & Manufacturing Company has received a $1,000,000 order for electrical equipment to be used in the New Chicago Civic Opera Building, which will house the Civic Opera Auditorium, the Civic Theater and forty-four stories of office space. The equipment ordered consists of elevators, all heating, ventilating and pump motors, lighting panelboards, power and elevator panels, an A.C. distribution switchboard and a ten-scene Multi-pre-set theater switchboard.

Sundh Electric Company, Inc., Newark, N. J., has appointed as representative in Georgia, Florida and South Carolina, E. H. Bollenbacher, formerly with McClelland and Junkersfeld. His headquarters will be at 805 Forsyth Building, Atlanta, Ga. J. W. Eshelman, who formerly handled this territory, will remain in Birmingham, but will cover Alabama only.

Copperweld Steel Company, Glassport, Pa., has established a Northeastern district under the management of George F. Bain. This territory includes all of the New England States and all of New York State north of Westchester and Rockland Counties. Headquarters are located at 30 Church Street, New York City. Paul Van Wagner is now district manager for Greater New York City, New Jersey, Pennsylvania and West Virginia. His offices are at 30 Church Street, New York City.

Beardslee Chandelier Manufacturing Company, Chicago, and R. Williamson & Company, lighting equipment manufacturers, have merged interests. The consolidation will be known as the Beardslee Chandelier Manufacturing Company. The exclusive designs of lighting equipment developed by R. Williamson & Company as well as the complete Beardslee line will continue to be manufactured.

General Electric Company reports that sales billed for the first six months of 1929 amounted to $194,353,307, an increase of 23 per cent over the corresponding period of 1928. Profit available for dividends on common stock for this period was $30,740,768.02, as compared with $24,388,002.58 for the same period of 1928.

Atwater Kent Manufacturing Company, Philadelphia, dedicated its new 32-acre factories in that city by nation-wide ceremonies which occupied the entire week of July sixth. Through the medium of local newspaper publicity, radio hookups, dealer window and store displays and movie newsreels of the dedication exercises, a record number of people were made acquainted with Atwater Kent expansion.

Dudlo Manufacturing Corporation, Fort Wayne, Ind., manufacturer of electric coils, wire, etc., has appointed Niles E. Wallen as sales production manager in charge of the advertising and export trade of its company, succeeding William S. Mossman, who has resigned. Perry Cooper will take over the Indiana and Michigan sales territory, part of which has been covered by Mr. Wallen.

Robbins & Myers, Inc., Springfield, Ohio, announces that W. W. Mumma, sales manager of the company, resigned July first. He had been connected with Robbins & Myers since 1885.

Ohio Electric & Controller, Cleveland, Ohio, has named as sales engineer with headquarters at the main office, R. N. Jessup, formerly district sales manager of the company's motor department, located at 334 N. Michigan Avenue, Chicago.

Fusion Welding Corporation, a subsidiary of the Chicago Steel & Wire Company, has taken over the sale of all welding rod manufacturing by the parent company. The address of both companies is 103rd Street and Torrence Avenue, Chicago.

Williams Oil-O-Matic Heating Corporation has named R. O. Ahlenius general manager of the corporation, a new position. He has been associated with Williams since August, 1928. W. J. Brevitt, who joined Williams in 1925 as a field man, has been made general sales manager. After acquiring some experience in the field he was promoted to sales promotion manager and then section sales manager in charge of New York and New England. He was named assistant sales manager in January, 1928.

Falk Corporation, Milwaukee, Wis., announces that Harold S. Falk, vice-president and general manager, has been appointed chairman of the Committee on Industrial Education of the National Metal Trades Association.

Ohio Electric & Controller Company, Cleveland, has appointed as sales engineer at the Cleveland factory, R. N. Jessup, formerly district sales manager of the company's motor department, 333 N. Michigan Boulevard, Chicago.

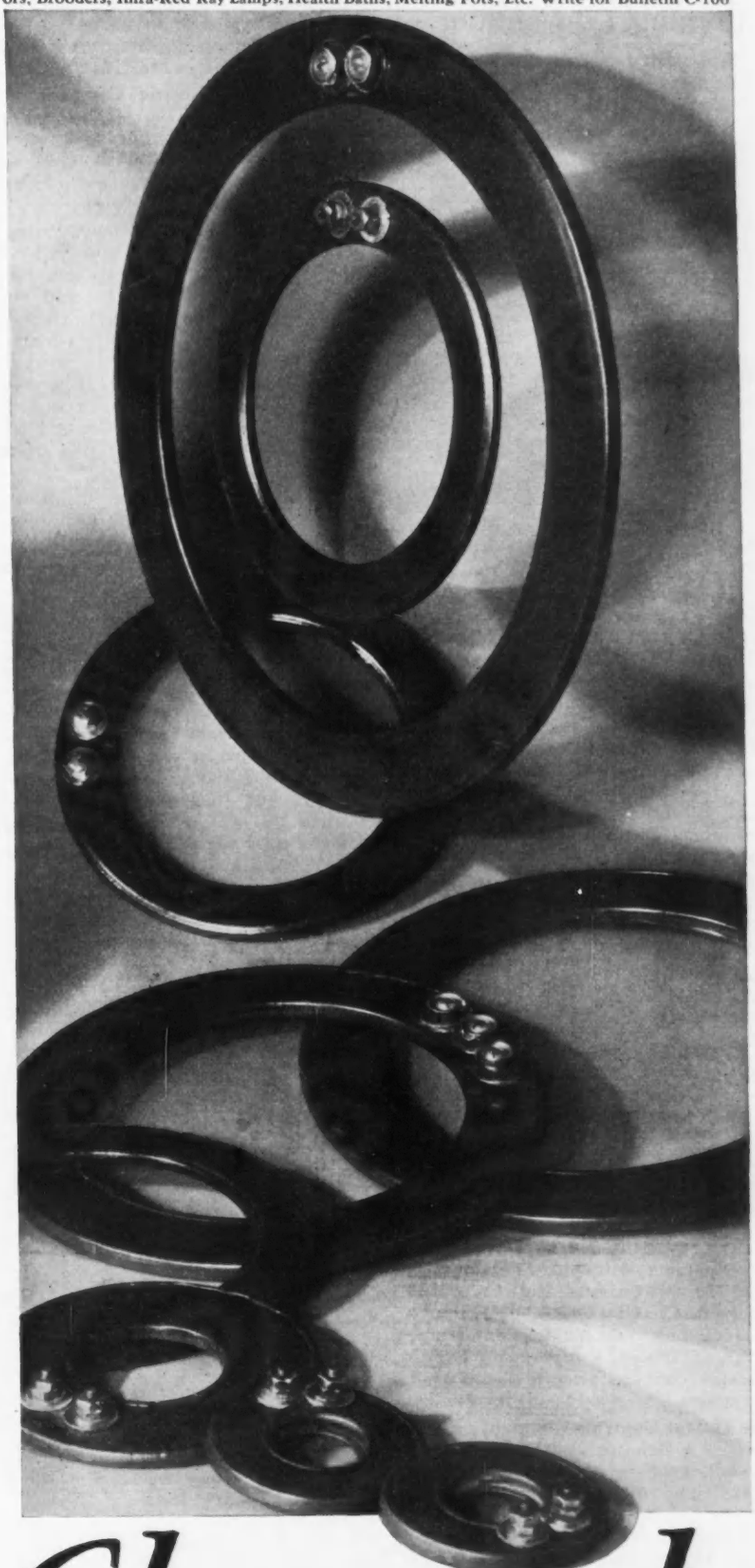
Wagner Electric Corporation, St. Louis, announces the addition of W. H. Kretz to the transformer sales division to travel the Southeast. He was formerly associated with the Public Service Company of Oklahoma and the Jeffry DeWitt Insulator Company.

Copeland Products, Inc., Detroit, reports that net profits for the first six months of this year reached $266,942.48. This is an increase of 17 per cent over the corresponding period of 1928.

Lincoln Electric Company has awarded a contract to the Austin Company for design and construction of an all-welded warehouse for steel storage to cost $65,000, at the Lincoln plant, Cleveland. Construction is under way and is scheduled for completion early in September. The warehouse will be one story, 68 by 200 ft. One hundred thirty tons of structural steel will be used with no rivets.

Frigidaire Corporation, Dayton, Ohio, reports that the first six months of 1929 were the greatest in its history. Shipments of household and commercial refrigeration units during this period showed gains ranging from 68 to 112

★Chromalox Ring Units, Single or 3-heat, 2½" to 11" diameter, 110 or 220 volts. Used by leading makers of Electric Ranges, Waffle Bakers, Coffee Urns, Percolators, Sandwich Toasters, Incubators, Brooders, Infra-Red Ray Lamps, Health Baths, Melting Pots, Etc. Write for Bulletin C-106



Make your products *trouble-free* . . . . . from the start

Over 60 far-sighted manufacturers are doing it Tests and experiments soon showed that it's more economical all around to equip products with patented Chromalox heating units.

IT'S like building an automobile . . . or a fine watch. The motor, the works, the insides must be right or it won't go. You are making appliances. Fine looking . . . latest designs . . . destined to be best-sellers.

The most important part of your product is out of sight

But what about the heating units that are out of sight and yet responsible for the every day successful operation of that waffle baker or electric range or water heater? Are they going to deliver the right heat everytime the switch is turned on?

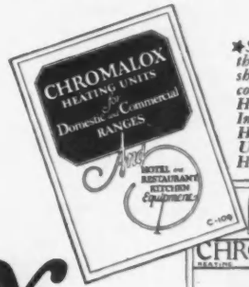
Not a single burn-out in 58,000 heaters

That report just comes from an ironing machine manufacturer. It's his five-year experience with Chromalox heaters. Other companies report similar satisfactory operating records. Your own products can be made just as trouble-free by using these patented Chromalox units.

Start now to make your products trouble-free

Customers call us in to show them the right way to build in the heating units. Result, assembly costs are lowered, trouble is side-tracked. Whether you are working on a new product or improving an old one, tell us about the appliances or heating devices you want properly heated. There's no obligation!

EDWIN L. WIEGAND CO.
7500 Thomas Boulevard, Pittsburgh, Pa.



★*Send for your copy of these 8-page bulletins showing the largest complete line of Strip Heaters, Ring Units, Immersion Heaters, High-Speed Range Units and Special Heaters.*

Chromalox
ELECTRIC HEATING UNITS

per cent over the same period of 1928. Water Coolers showed an 82 per cent gain.

General Electric Company has transferred Charles E. Eveleth, who since 1917 has been a vice-president connected with the company's manufacturing department, to the engineering, where he will be associated with E. W. Allen in the direction of that department's affairs. Mr. Eveleth will give special attention to the problems of the designing departments and works laboratories. Mr. Allen will be occupied with the commercial engineering, contract service and district engineering departments.

C. E. Mountsford, manufacturer of resistances, with offices and laboratories at 105 Sixth Avenue, New York City, has appointed Rosse M. Gilson of Los Angeles, as representative for California, and G. M. Cameron of Cleveland Heights for Ohio. C. E. Raymond has been named to cover the New York territory, while W. S. Sole, formerly of the New Jersey Bell Telephone Company, has joined the Mountsford engineering staff.

Bryant Electric Company, Bridgeport, Conn., has arranged with the Metropolitan Life Insurance Company for an employee group insurance program. Every employee who has been with the company for six months or longer receives $500 life insurance free for which the Bryant Electric Company pays the entire cost and the employee may purchase additional insurance through this special plan according to the salary received.

Hammarlund Manufacturing Company, Inc., 424 W. 33 Street, New York City, announces that the sales of EC model condensers increased thirty per cent during the first six months of 1929. Over a quarter of a million dollars of these popular condensers were sold during this period, the company reports.

Coming Conventions

American Institute of Electrical Engineers.—Pacific Coast convention, Los Angeles, Cal., Sept. 3-6. Annual winter meeting at New York City, Jan. 27-31, 1930.

American Society of Mechanical Engineers.—Third national meeting of the Iron and Steel Division during the Steel Treaters' Convention, Cleveland, Ohio, Sept. 11-13. Third national fuels meeting at the Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 7-10.

Chattanooga Power and Mechanical Exposition, in conjunction with 47th Convention of the National Association of Power Engineers, Chattanooga, Tenn., Sept. 9-13, inc. Frank N. Chapman, care of A. Leschen & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo., secretary of the National Exhibitors' Association.

National Association of Power Engineers.—47th Annual Convention, Chattanooga, Tenn., Sept. 9-13, inc. The Power and Mechanical Exhibition will be conducted in conjunction with the convention. Ivon F. Pieters, president, Plibrico Jointless Firebrick Company, 1800 Kingsbury St., Chicago, Ill. S. M. Chapman, secretary, 5909 Kennerly Ave., St. Louis, Mo.

National Electrical Manufacturers Assocation.—Annual fall meeting at the Wardman Park Hotel, Washington, D. C., Oct. 7-12.

National Metal Congress. — Cleveland, Sept. 9-13. Simultaneous meeting will be held of the American Welding Society, American Society of Mechanical Engineers (Iron & Steel Division), American Society for Steel Treating.

Obituary

Armistead K. Baylor, commercial engineer of the General Electric Company and veteran of the electrical industry, died at the age of 61, Aug. 1, at his summer home, Ipswich, Mass. In 1894 he moved to Schenectady when the G. E. headquarters were established there. For fourteen years he was connected with British Thomson-Houston Company, but then rejoined General Electric. He was also vice-president and member of the board of the Edison Electric Appliance Company.

Thomas E. Murray, for many years a vice-president of the New York Edison Company and head of the engineering firm which bears his name, died at his home in Wickapogue, L. I., July 21, aged 68 years. He was an inventor of note in the electrical field and was identified for most of his career, with the engineering end of central station power plants.

Manufacturers Literature

ELECTRICAL MANUFACTURING *presents a digest of recently issued catalogs, bulletins and other advertising material. Manufacturers are invited to send literature for review in this column.*

Westinghouse Electric & Manufacturing Company, E. Pittsburgh, Pa. "Power at the Touch of a Button," special publication No. 1842, describes linestarters and linestart motors and their application to modern industries. The booklet explains the linestarter principle which permits motor control at the push of a button and the linestart motor which may be started across the line without the use of the linestarter if high starting current is not objectionable. The features and applications of the equipment are described. Numerous illustrations supplement the description.

Electric Controller & Manufacturing Company, Cleveland, Ohio. Bulletin 970 describes A. C. manual controllers including V-4 Dinkey controllers for use with Duplex drives using two motors mechanically connected to the same drive. Bulletin 1021 covers D.C. Type "S" crane switchboards including 115 and 550 volt ratings. Bulletin 1037-D covers A. C. and D. C. Type B limit stops including new style contactor. Price sheet 1004-A applying to Type WB brakes contains price revisions recently effected.

Time-O-Stat Controls Company, Elkhart, Ind. A new forty-six page booklet describes in detail this company's complete line of automatic control equipment for oil burners, electric refrigerators, industrial ovens, mechanical stokers, ice machines, unit heaters, water heaters, sign flashers, mercury switches and electric heaters. The booklet is copiously illustrated.

Alden Manufacturing Company, Inc., Brockton, Mass. A new booklet which deals with the radio socket manufactured by this company. A detailed account of the methods employed in manufacturing the socket and the benefits to be derived from its use are set forth in this booklet. Attachment plugs and special adapters are also described.

Frank Adam Electric Company, St. Louis. Bulletin No. 47, "Fuslok" switchboards, dead front and safety type. A discussion of the switches' capacities, operating mechanisms, assembly, installation and operation.

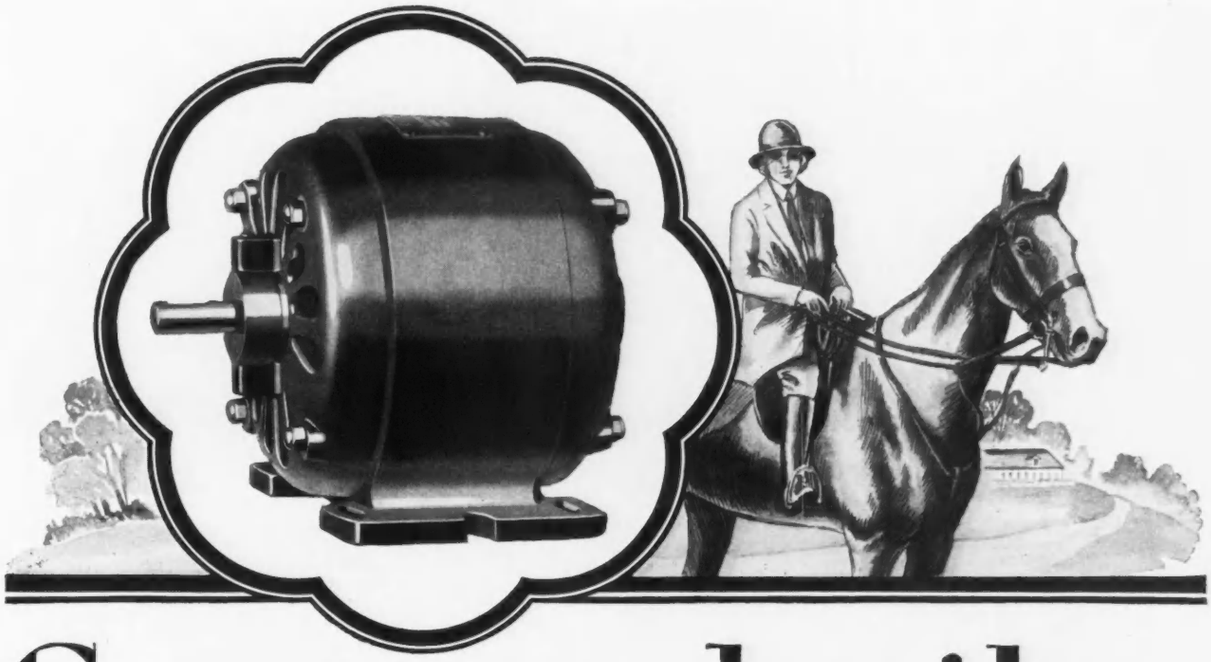
Electric Furnace Company, Salem, Ohio. "From Steel Balls to Oil Stills" is the title of a new booklet which lists some of the numerous parts and materials treated in electric furnaces. Under each listing are entries representing customers using this company's furnaces for treating the part named, the number of furnaces built for various applications for each customer and the total kw. rating. Names of the users will be furnished on request.

Information Wanted

We have been asked for the names and addresses of manufacturers of the articles listed herewith.

Replies from our readers to any of these inquiries will be greatly appreciated by the Information Bureau of ELECTRICAL MANUFACTURING 461 Eighth Avenue, New York City.

"Parker" Canopy Insulating Block.
"Reliance Knight" Lamps.
"Burrows" Therapeutic Lamp.
"L. R. Co." Receptacles.
"Williams" Commutator Dressing.
"Splendida" Electric Iron.
"Flint" Waffle Iron.
"Pioneer" House Pump.
"Blaisdell" Electric Cigar Lighter.
"Defiance" Cigarette Lighter.
"Hillcrest" Line of Lighting Fixtures.
"Vesodore" Cigar Lighter.
Electric-driven lampshade lacing machines.
Steel Collapsible Barrels used for post hole digging.



Custom built –

Copper, Iron plus insulation—these are the principal raw materials that make up a Motor.

Naturally the quality of these materials is of first consideration in producing a good Motor. That is why all raw materials for Ohio Motors must pass such rigid specifications.

With good raw materials as a basis, each machining operation of Ohio Motor parts must meet an accuracy of plus or minus a few ten thousandths of an inch.

Even with this combination of good raw materials and accurate assembly operations, each Ohio Motor must pass a series of 14 individual tests before it is approved for shipment.

True, such a Custom Built Motor costs slightly more than an average Motor. However, the long list of satisfied Ohio Motor Users is the most convincing argument that this Quality in Motors is well worth the price.

Ohio Motors meet all N.E.M.A. and N.E.L.A. specifications. 1/20 to 1/4 Horse Power.

OHIO reliable MOTORS

The Ohio Electric & Controller Co.
5903 Maurice Avenue—Cleveland, Ohio

OHIO MOTORS

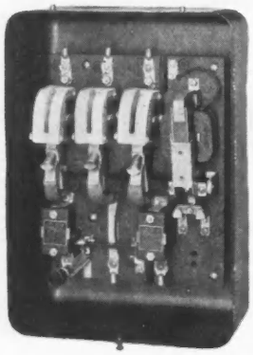
New Goods for Your Inspection

Mountford Resistor

Mountford Laboratories, 105 Sixth Avenue, New York City, have placed on the market a resistor for use in radio circuits. It has great mechanical strength and high heat conductivity. The resistor is self insulated in that the core or body is insulated and entirely covered by an outer substance, thus eliminating the possibilities of leakage or shorting. The terminals have corrugated ends that are thoroughly embedded in the core.

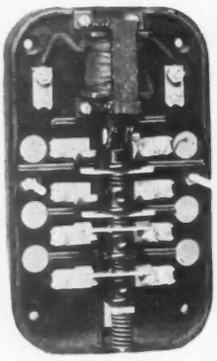
G. E. Magnetic Switch

General Electric Co. Schenectady, N. Y., has introduced a model CR-7006-D-30 magnetic switch to supersede the type CR-7006-



D-4. It is designed primarily for throwing small motors directly across the line, although it can be used as a primary switch with slip ring motors having secondary control. The changes in the present model include the use of a molded shaft thermal overload relays with interchangeable heater units, silver contacts of the holding interlock, an E frame magnet and restricted type blow-outs.

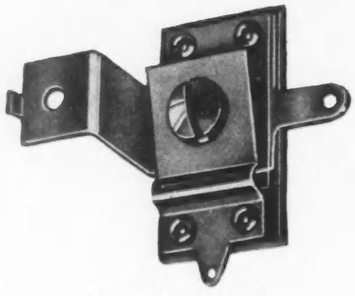
G. E. Multi-Finger Relay



General Electric Co., Schenectady, N. Y., is making a relay designed to supply the demand for a multi-finger, alternating current device for general purpose use. It consists of a series of double-break, silver-faced fingers operating horizontally and controlled by a small solenoid, power consumption of the latter being 8 watts. The complete unit is mounted upon a molded base, over which is drawn shell cover. The base is provided with holes, through which leads may be run when the relay is mounted as a panel device.

Hammarlund Equalizing Condenser

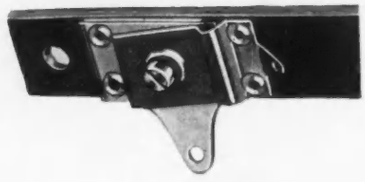
The Hammarlund Mfg. Co., Inc., 424-438 West 33rd Street, New York City, is



Model EC-35-KN3

manufacturing two different models of an equalizing type of condenser. On all models the capacity is varied by means of a screw which runs through a phosphor-bronze spring plate and which controls the distance between this plate and a piece of brass mounted on a Bakelite strip.

The EC-35-KN3 type contains any number of equalizers mounted on a Bakelite strip. The adjusting screw is dead, being insulated from the spring plate by a hard rubber washer. It can be used for both neutralizing and equalizing and is made in any capacity, e.g., less than 2 mmfd. to more than 35 mmfd., or less than 20 mmfd. to more than 100 mmfd.



Model EC-35-KFB

The EC-35-KFB type has a special bracket which enables insertion into a slot into the subpanel, thus aiding its support and simplifying the wiring. It also is made in the same capacities as the EC-35-KN3 and can be used for feedback control, equalizing or as a grid condenser in short wave receivers. It has a live screw as on all standard models. A wooden adjuster is used to prevent capacity variation.

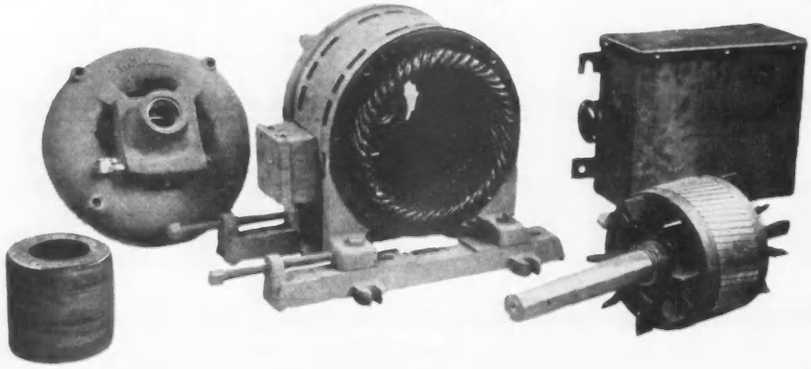
Hammarlund Midget Condenser

The Hammarlund Mfg. Co., Inc., 424-438 West 33rd Street, New York City, is marketing a type MC-19-G midget condenser that is intended primarily for antenna tuning. It has a special base mounting and a long brass shaft for operation from the panel. The length of this shaft

is made to suit, and the condenser is made in capacities from 16 mmfd. maximum to 100 mmfd. maximum. The plates are cut in straight line capacity style. They are made of brass and are soldered to the shaft. Bakelite insulation is used, lock washers are used under all screws and the mounting plate is made of chemically treated steel.

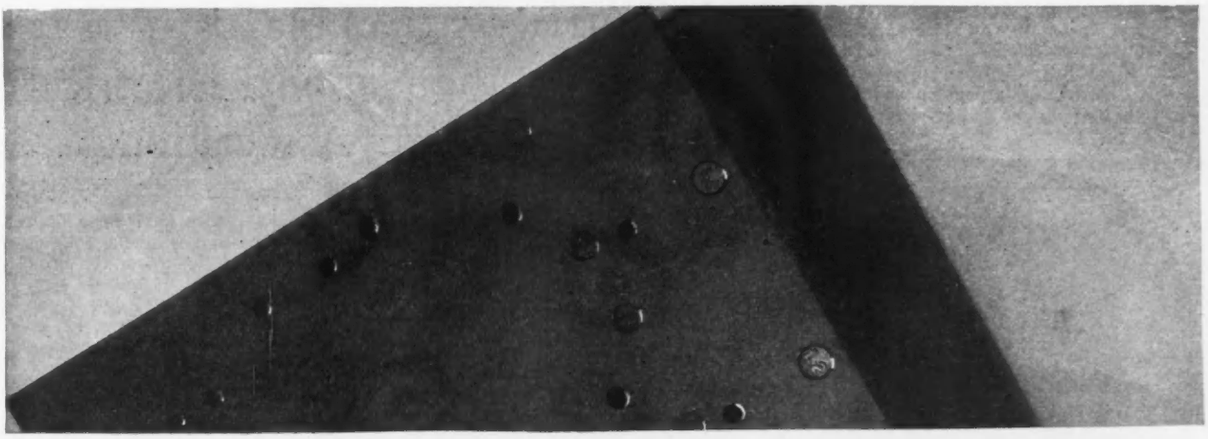
Howell Electric Motor

Howell Electric Motors Co., Howell, Mich., has introduced a brushless single phase motor. As an auxiliary part of the motor there is a starting unit that contains starting condensers and an automatic contactor that disconnects the condensers from the circuit as the motor reaches full speed. Because of this feature the motor has no brushes, commutators, internal switching devices or wire-wound rotor. The motor can be reversed at full speed making it practical for use in single phase operation on machine tools, elevators, hoists, etc.

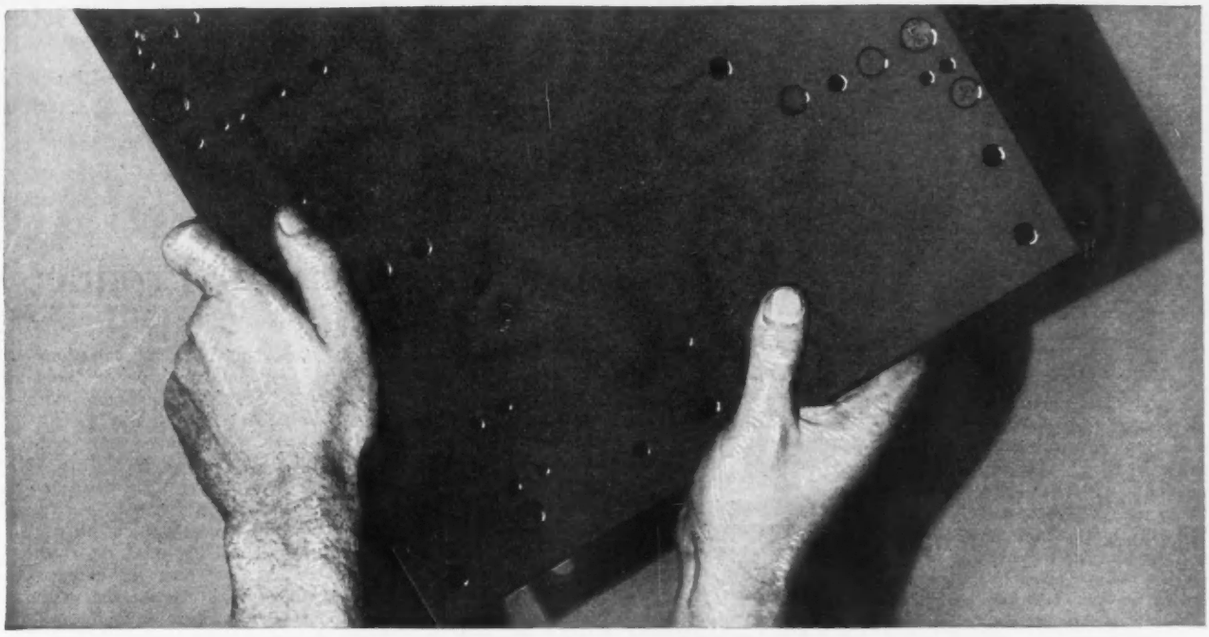


Controller for Small Motor

Westinghouse Electric and Mfg. Co. has announced a controller of the drum type which provides across-the-line starting for small D. C. motors. The controller is provided with fuses mounted inside of the controller case and interlocked with a



Moulded electrical bases up to 400 sq. inches



MANUFACTURERS of knife switches, starters or panel mounted control equipment, can now obtain *moulded* bases and parts in large sizes that will withstand shock and vibration.

Moulded Ebony Insulation, light in weight, has high dielectric strength and the special advantage that it is moisture proof. It will not absorb dampness from the atmosphere even when exposed to sea air. It is free from laminations. It will not vary, shrink, crack or buckle, rot or rust under extreme service conditions.

The fact that all holes, counter bores, slots, etc., are moulded into the finished piece makes Moulded Ebony Insulation preferable and more economical than material on which the machine expense is made costly by the necessity of machining operation with the attendant breakage hazard.

Johns-Manville Asbestos Ebony has long been famous for its performance as switchboard material in central stations, sub-stations, industrial plants, battleships and dredges and in mines all over the world. Equally high standards of performance can be counted on when the same material is used in moulded form for instrument bases and apparatus mounts.

JM Johns-Manville
ASBESTOS EBONY MOULDED

JOHNS-MANVILLE CORPORATION
New York Chicago Cleveland San Francisco Toronto
(Branches in all large cities)

Please send me further information about the application of Moulded Ebony Insulation for electrical bases and parts.

Name.....

Company.....

Address.....

AE—103-8

screw type cover to meet the requirements of the U. S. Bureau of Mines for explosion-tested equipment. Accessibility is one of the features of this small controller which is provided for by mounting the entire controller on the bottom base. The

bottom base is threaded to screw into a cylindrical case. Removing this case uncovers the entire controller for inspection or maintenance.

The controller is designed as a small compact unit for application on permissible type conveyors, pit car loaders, room hoists, small pumps and similar types of apparatus where explosion-tested equipment is required.

Automatic Motor Control

Square D Company, Detroit, Mich., is marketing a combination starter for automatic electric motor control. It is made in three ampere capacities and in six types; making use of across-the-line starters up to 30 hp., 220 volts, and 50 hp., 440 and 550 volts, two or three phase. Each starter is a complete unit, consisting of an across-the-line starter combined with a motor circuit switch, mounted together in one cabinet. To facilitate in obtaining ac-

curate load data on motors, while they are operating under working conditions, the combination starters are arranged for the insertion of a test jack in the motor circuit switch while the motor is running. The jack is inserted through openings in the door of the starter and passes between the jaws of the switch, where it is firmly held by the spring tension of the switch contacts. Test jacks may be ordered separately, when desired.

Industrial Control Standards as Adopted by the National Electrical Manufacturers Association

(*Continued from page* 66)

(Omit this paragraph if open controller is desired.) Controller shall be of the closed type.

f. *Disconnecting Means.*
(Omit this paragraph if the disconnecting means is not to be furnished as part of the control equipment.) The switch or circuit breaker required shall be furnished as part of the control equipment. (If the purchaser has any preference as to whether it shall be mounted on the controller or separate therefrom it should be specified.)

g. *Mounting.*
(Omit this paragraph if method of mounting is not important). Controller shall be arranged for:
Floor mounting.
Wall mounting.

h. *Pilot Device.*
(Omit this paragraph if manual operation is specified.)
The pilot device shall be a (select means desired from the following list).
Float switch.
Pressure regulator.
Vacuum regulator.
Pushbutton master.
Speed indicating pushbutton.
Station.

i. *Dual or Duplex Control.*
(Omit this paragraph unless dual or duplex control is used). The dual control shall be (select type desired):
Dual manual.
Dual automatic.
Dual manual and automatic.
The duplex control shall be (select type desired):
Duplex manual.
Duplex automatic.
Duplex manual and automatic.

Specifications for Electrical Products

(*Continued from page* 48)

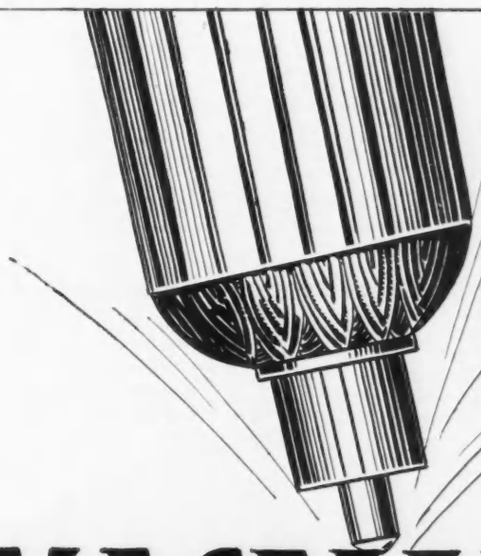
Such materials can be purchased only through approved suppliers whose product has been subjected to investigation both in the laboratory and in service and has proved satisfactory. In these cases the supplier must understand how the material is used, and agree not to make any changes in it until the change has been tested and approved. In addition to this understanding, it is well to prepare a specification covering certain easily determined and significant properties so that any change may be detected before the material is used in production. With the best of intentions, suppliers sometimes make mistakes or gradual changes in succeeding shipments which cause the final product to differ materially from the initial shipment which was tested and proved satisfactory.

This combination of a simple specification, which does not cause too much trouble and expense to the inspection department, with approved suppliers, makes the best arrangement in the purchasing of materials provided enough sources of supply are approved to allow proper competition in purchasing, and provided the plan is made flexible enough to enable new suppliers to get on the list. This latter provision is important as it gives the purchaser a chance to keep up with developments in the art.

In every case, suppliers should be given an opportunity to comment on the specification before it is finally issued. It may seem adequate in every way and with no unnecessary provisions but frequently certain requirements are given in such a way as to work a hardship on the supplier. An example of this occurred in a specification for insulating paper, slit to six inches wide and shipped in long lengths in rolls. It was important that the variations in thickness from side to side of the six-inch strip be kept at a minimum, but the change in thickness from end to end of the strip was not so important. In the effort to be brief, these provisions were worded in such a way that the supplier interpreted it to mean that the close variations applied to all the paper at all points, and stated he could not meet the requirements. After re-wording the paragraphs involved so as to bring out the meaning more clearly, the specification was accepted as being well within commercial practice.

There are many sources of material for a specification. The most important, of course, are the needs of the application in which it is to be used. If these are fully understood, no other information is required. If other help is required, there are a large number of engineering societies that have issued specifications available to the public. The Government bureaus have covered practically the whole field of materials, and many large corporations will send copies of the specifications they have, covering the material in question, free of charge. With these at hand, the requirements for the particular application in mind can readily be chosen and used.

Buyers of large experience who have used specifications prepared as outlined in this article are strong supporters of the principle that specifications are a help in buying and are constantly requesting that more be issued, expecting eventually to have the whole field of their materials covered with such evidence as proof there can be no doubt of the value of properly prepared and used specifications.



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Index of Raw Materials, Parts, Electrical Equipment

For all electrical products including electrically operated machines and appliances

Trade Names—Manufacturers' Names—Local Addresses

The names of all manufacturers are grouped alphabetically under the heading for the product they manufacture. Trade names also appear in alphabetical position under the subject identifying the product. Thus "Linolac" insulating varnish will be found in alphabetical position under the heading "Paint, Varnish, Lacquer."

Note: The Classified Index of ELECTRICAL MANUFACTURING is limited to those subjects of interest to the specific field which it covers, for obvious reasons. A complete Classified Index of all electrical commodities bought, sold, or used by Electrical Supply Jobbers, Contractors, Dealers, Central Stations and other electrical industry outlets appears regularly in each issue of ELECTRICAL RECORD as heretofore.

ALLOYS, LIGHT METAL
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.

ALUMINUM
(Also Aluminum Bronze Powder.)
Albron, Alcoa, Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh.

AMMETERS. See Instruments.

ARMATURE
Balancers. See Balancers, Armature.
Banding Machines. See Banding Machines, Armature Bearings. See Bearings.
Buggies. See Lifts, Armature.
Coil Presses. See Presses, Armature Coil.
Coils. See Coils, Finished.
Core Punchings. See Discs, Armature.
Cranes. See Lifts, Armature.
Discs. See Discs, Armature.
Driers. See Ovens.
Growlers. See Testers, Coil.
Hoists. See Lifts, Armature.
Impregnators, Vacuum. See Ovens, Industrial.
Jacks. See Lifts, Armature.
Laminations. See Discs, Armature.
Lathes. See Lathes.
Lifts. See Lifts, Armature.
New. See Coils, Finished.
Notching Machines. See Notching Machines, Armature.
Pegs. See Pegs, Armature.
Pinion Pullers. See Pullers, Armature Shaft.
Repaired. See Repairing and Second-Hand.
Shaft Pullers. See Pullers, Armature Shaft.
Shaft Straighteners. See Straighteners, Armature Shaft.
Stands. See Stands, Armature.
Test Benches. See Test Benches, Armature.
Testers. See Testers, Coil; also Test Benches, Armature.
Torpedo Cord. See Twine, Armature Winding.
Trouble Shooters. See Testers, Coil; also Test Benches, Armature.
Trucks. See Lifts, Armature.
Wedges. See Pegs, Armature.
Winding Machines. See Winding Machines, Armature & Field Coil.
Winding Twine. See Twine, Armature.

ARMATURE & COIL SPRAY GUNS. See Spraying Outfits.

ARMORING MACHINES. See Wire Manufacturing Machines.

ARMS, FLEXIBLE. See Tubing Flexible Metallic.

ASBESTOS Shades. See Shades, Fabric.
Paper & Sheet. See Asbestos.
Slabs. See Asbestos Slabs.
Tape. See Tape, Asbestos.
Wire. See Wire, Insulated.
Yarn and Thread. See Yarn and Thread.

ASBESTOS
Sheet, Paper, Mill Board, Lumber.
Ambler Asbestos Shingle & Sheathing Co., Ambler, Pa.
Easco. See Eastern Asbestos Co.
Eastern Asbestos Co., Providence, R. I.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp., New York, N. Y.

ASBESTOS SLABS
Slabs & Barriers for Switchboard.
Asbestos-Ebony. See Johns-Manville, Inc.
Ambler Asbestos Shingle & Sheathing Co., Ambler, Pa.
Decelco, Inc., Wayne, Mich.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp., New York, N. Y.
Transite. See Johns-Manville, Inc.
Zellite. See Decelco, Inc.

BAGS, Vacuum Cleaner
Merrimack Mfg. Co., Boston, Mass.

BALANCERS, Armature
(Dynamic Balancing Machines—Balancing Ways).
Anderson Bros. Mfg. Co., Rockford, Ill. (Ways).
Armature Coil Equip. Co., 2415 Forestdale Ave., Cleveland, O. (Machine).
Bowsher Co., N. P., South Bend, Ind.
Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. (Machines).
Sundstrand Machine Tool Co., Rockford, Ill.
Twentieth Century. See Sundstrand Machine Tool Co.
Vibration Specialty Co., 1534 Winter, Philadelphia, Pa. (Machines).

BALL BEARINGS. See Bearings, Ball and Roller.

BANDING MACHINES, Armature
Columbia Machine Wks. & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.

BARRIERS, Switchboard. See Slate; also Soapstone; also Asbestos.

BARS, BUS. See Brass, Bronze & Copper; also Aluminum.

BARS, Commutator
Anaconda. See American Brass Co.
American Brass Co., Waterbury, Conn.
Buckeye Tempered Copper & Brass Co., Mansfield, O.
Cameron Electric Mfg. Co., Ansonia, Conn.
Commutator Co., 121 N. Front, Minneapolis, Minn.
Electric Materials Co., North East, Pa.
Eureka Metal Products Corp., 91 Clay, North East, Pa.
Homer Commutator Co., 4743 Hough Ave., N. E., Cleveland.
Rome Brass & Copper Co., Rome, N. Y.

BASES, Radio Tube. See Radio Molded Parts.

BASES, Reading Lamp
Metal, Pottery, Wood & Glass.
American Ring Co., Waterbury, Conn.
Aladdin Mfg. Co., Muncie, Ind.
Armor Bronze Co., Garwood, N. J.
Camden Art Tile & Pottery Co., Camden, Ark.
Colonial. See Old Colony Iron Wks.
Estes & Sons, E. B., 5844 Grand Central Terminal, New
Fulper Pottery Co., Flemington, N. J.
Globe Metal Spinning Co., 178 Centre, New York, N. Y.
Hemill Products, Inc., 103 Mott, New York, N. Y.
Insulation Mfg. Co., New York Ave. and Heckimer St., Brooklyn, N. Y.
Marbleart. See Insulation Mfg. Co.
Natural. See Insulation Mfg. Co.
Old Colony Iron Wks., Bridgeport, Conn.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sneath Glass Co., Hartford City, Ind.
Van Briggle Tile & Pottery Co., Colorado Springs, Colo.
Weller, S. A., Zanesville, O. (Pottery.)
Yokel Corp., 219 Homestead Ave., Hartford, Conn.
Zane Pottery Co., South Zanesville, O.

BATTERY CHEMICALS. See Chemicals, Battery.
BATTERY CUT OUTS. See Switches, Battery.
BATTERY GAGES. See Instruments, Pocket.
BATTERY JARS. See Jars, Battery, Glass; also Rubber; also Molded Insulation.
BATTERY OXIDES. See Chemicals, Battery.
BATTERY SALTS. See Chemicals, Battery.
BEAD CHAIN. See Chain, Socket.
BEADS, Chandelier. See Crystals, Chandelier.

BEADS, Insulating
American Lava Corp., 1425 William, Chattanooga, Tenn.
Durco. See Struthers Dunn, Inc.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.

BEARINGS
Ball & Roller. See Bearings, Ball & Roller.
Graphite. See Bearings, Oil-less.
Oil-less. See Bearings, Oil-less.
Sleeve. See Bearings & Bushings.

BEARINGS, Ball and Roller
Ahlberg Bearing Co., 312 E. 29th, Chicago, Ill.
Auburn Ball Bearings Co., 73 Clarissa, Rochester, N. Y.
Bantam Ball Bearing Co., South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Commercial. See Schatz Mfg. Co.
C J B. See Ahlberg Bearing Co.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearing Co., Poughkeepsie, N. Y.
Gurney. See Marlin-Rockwell Corp.
Hyatt Roller Bearing Co., Newark, N. J.
Hoffman. See Norma-Hoffman Bearings Corp.
McGill Metal Co., Valparaiso, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
New Departure Mfg. Co., Bristol, Conn.
Nice Ball Bearing Co. (Nicetown), Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Whitehead Rd., Trenton,
Schatz Mfg. Co., Poughkeepsie, N. Y.
Schubert. See McGill Metal Co.
Standard Steel & Bearings, Inc., Plainville, Conn.
Strom Bearings Co., 4587 Palmer, Chicago, Ill.
S. K. F. Industries, 40 E. 34th, New York, N. Y.
Timken Roller Bearing Co., Canton, O.
Torrington Co., Torrington, Conn.

BEARINGS, Oil-Less
Argute Oilless Bearings Co., 149 Berkeley, Philadelphia, Pa.
B. M. C. See Burlington Metal Corp.
Bogert & Hopper, Inc., 215 Varick, New York, N. Y.
Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Burlington Metal Corp., Burlington, Wis.
Cleveland Graphite Bronze Co., 880 E. 72nd, Cleveland, O.
Electric Railway Equipment Co., 30 Church, New York, N. Y.
Elreco. See Electric Railway Equipment Co.
Graphalloy. See Graphite Metallizing Co.
Graphite Metallizing Co., Yonkers, N. Y.
Lubrite. See Merriam Bros., Yonkers, N. Y.
Merriam Bros., 185 Amory, Boston, Mass.
Metal Saw & Machine Co., Springfield, Mass.
Moraine Products Co., First & Foundry Sts., Dayton, O.
Neveroil Bearing Co., Wakefield, Mass.
Nolu Oilless Bearing Co., 6 E. Johnson, Philadelphia, Pa.
O. & S. Bearing Co., 315 S. Artillery, Detroit, Mich.
Reliance. See Metal Saw & Machine Co.
Selb Lignum-Vitae Woodturning Co., 93 Boyd Ave., Jersey City, N. J.
United States Graphite Bearing Co., Saginaw, Mich.

BEARINGS AND BUSHINGS
(For Armature Shafts.)
Adjustable Bearing Co., 101 Transportation Bldg., Indianapolis, Ind.
Ajax Metal Co., Philadelphia, Pa.
American Bronze Corp., Berwyn, Pa.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bunting Brass & Bronze Co., Toledo, Ohio.
Damascus Bronze Co., Pittsburgh, Pa.
Durex. See Moraine Products Co.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit,
Flood City Mfg. Co., Johnstown, Pa.
Johnson Bronze Co., Dept. G, New Castle, Pa.
Lumen Bearing Co., Buffalo, N. Y.
Moraine Products Co., First & Foundry Sts., Dayton, O.
National Bearing Metal Corp. (More-Jones Brass & Metal Div.), 4930 Manchester Ave., St. Louis, Mo.
United States Graphite Co., Saginaw, Mich.

BELTING, Chain Transmission. See Chain, Power Transmission.

BELTS, Rubber
Molded Cord Rubber Belts for Electrical Appliances.
Fay Rubber Products Co., Elyria, O.
Gilmer Co., L. H., Cottman & Keystone Sts. (Tacony), Philadelphia, Pa.

BENDERS, Coil Loop
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.

BENDING. See Punching & Bending.
BINDING POSTS. See Posts, Binding.

BLADES, Fan
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y.
Torrington Mfg. Co., Torrington, Conn.

BLUESTONE. See Chemicals, Battery.
BOARD, Fuller. See Cloth and Paper.
BOARD, Press. See Cloth and Paper.
BOMBARDING MACHINES. See Machines, Lamp Making.
BOWL HOLDERS. See Fixture Fittings.
BOX & CABINET BUSHINGS. See Bushings, Box & Cabinet.

BOX BOARD
Container Corp. of America, 111 W. Washington, Chicago.
Mid-West Box Co., 111 W. Washington, Chicago.

BOXES, Fibre
Container Corp. of America, 111 W. Washington, Chicago.
Corrfibre. See Container Corp. of America.
Mid-West Box Co., 111 W. Washington, Chicago.

BOXES, Sheet Steel. See Cabinets, Sheet Steel.
BOXES, Wood. See Cabinets & Boxes, Wood.

BOXES AND WRAPPERS
Agar Mfg. Corp., Whippany, N. J.
Brown & Bailey Co., 417 N. Eighth, Philadelphia, Pa.
Bulldog. See Pittsburgh Corrugated Paper Box Co.
Campbell Paper Box Co., South Bend, Ind.
Consolidated Paper Co., Monroe, Mich.
Container Corp. of America, 111 W. Washington, Chicago.
Gair Co., Robert, 420 Lexington Ave., New York. (Boxes.)
Gator-Hide Kraft. See International Paper Co.
Hinde & Dauch Paper Co., 322 Decatur, Sandusky, Ohio.
Huntington Paper Box Co., Huntington, Ind.
International Paper Co., 100 E. 42nd, New York, N. Y.
Lake Lithographing Co., 2570 Superior Ave., Cleveland, O. (Display Cartons.)
Mid-West Box Co., 111 W. Washington, Dept. 36, Chicago
National Folding Box Co., New Haven, Conn. (Cartons.)
Pequot Mfg. Corp., Glendale (L. I.), New York.
Pittsburgh Corrugated Paper Box Co., Pittsburgh, Pa.
River Raisin Paper Co., Monroe, Mich.
Rockford Fibre Container Co., Rockford, Ill.
Sefton Mfg. Co., 56 E. Madison, Chicago, Ill.
Shuttleworth Carton Co., 474 W. Broadway, New York.

BRACKETS, Instrument
For Suspending Meters to Station Switchboard.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

BRAIDING MACHINES. See Wire Manufacturing Machines.

BRASS TUBING. See Tubing, Brass and Copper.

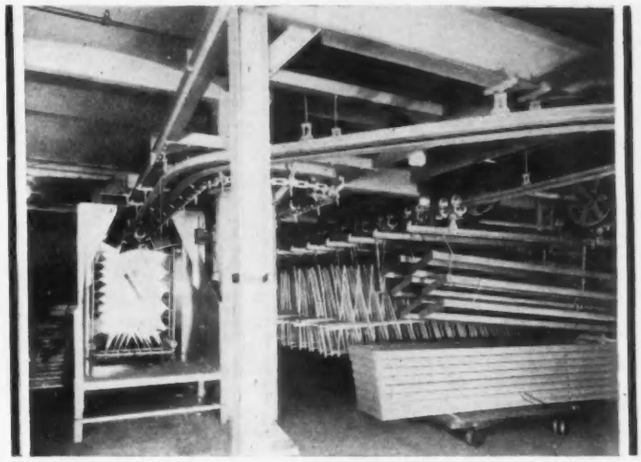
BRASS, BRONZE AND COPPER
Sheet, Rod, Bar.
Anaconda. See American Brass Co.
American Brass Co., Waterbury, Conn.
American Nickeloid Co., Peru, Ind.
Baltimore Brass Co., 1212 Wicomico, Baltimore, Md.
Baltimore Copper Mills, (Div. of General Cable Corp.) Baltimore, Md.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Buffalo Bronze Die Cast Corp., 100 Arthur, Buffalo, N. Y.
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
Durbar. See Buffalo Bronze Die Cast Corp.
Electric Materials Co., North East, Pa.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit,
Higgins Brass & Mfg. Co., 12435 Dequindre, Detroit, Mich.
Michigan Copper & Brass Co., 5851 W. Jefferson Ave., Detroit, Mich.
Nickeloid. See American Nickeloid Co.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Taunton-New Bedford Copper Co., Taunton, Mass.
Titan Metal Mfg. Co., Bellefonte, Pa. (Rods and Forgings.)
Western Cartridge Co., East Alton, Ill.

BREAKERS, Circuit. See Circuit Breakers.
BRIDGES, Wheatstone. See Instruments, Laboratory Stand ard.
BRONZE. See Brass, Bronze and Copper; also Castings
BRONZE, Phosphor. See Phosphor Bronze.
BRONZE POWDER, Aluminum. See Aluminum.
BRUSH HOLDERS. See Brushes, Commutator.

BRUSHES, Carbon. See Brushes, Commutator.
Graphite. See Brushes, Commutator.
Metal Graphite. See Brushes, Commutator.

BRUSHES, COMMUTATOR
(Brushes, Brush Holders and Flexible Leads.)
Brush Holders ..... See B
Carbon, Graphite, Metal Graphite ..... See C
Flexible Leads and Pig Tails ..... See L
Sheet Metal ..... See S
Wire Gauze ..... See W
Automotive Mfg. Co., Kansas City, Mo. ..... H
B. B. B. See Becker Bros. Elec'l Corp.

Finished with Bright Enduring ALUMINUM PAINT



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ALUMINUM PAINT
"IT LEAFS"

BRUSHES, Commutator—Continued
Baylis Co., Bloomfield, N. J. . . . . H
Becker Bros. Elec. Corp., 23 N. Jefferson, Chicago, Ill. . . . . C W S H L
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y. C
Boxlii-Bruel Carbon Co., Columbia Park, O. C . . . H
Calebaugh Self-Lubricating Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. C
Carbon Engrg. Co., Slinger, Wis. . . . . C . . . .
Carbon Laboratories Co., 5005 Euclid Ave., Cleveland, O. C
Carbon & Graphite Corp., 227 West Broadway, New York, N. Y. C
Carenco. See Carbon Engineering Co.
Chapin Co., Chas. E., 227 Fulton St., New York, N. Y. . . . . C W S . . L
Columbia Machine Wks., & M. I. Co., 253 Chestnut, Brooklyn, N. Y. . . . . H
Cooley Mfg. Co., 98 Park Place, New York . . W
Diamond C. See Chapin Co., Chas. E.
Dixon Crucible Co., Joseph, Jersey City. . . . . .
Electra. See Automotive Mfg. Co.
Electric Accessories Co., 310 York Ave., Philadelphia, Pa. . . . . H
Electro-Nite Carbon Co., 308 N. Fourth, Philadelphia Pa. . . . . .
Eureka Metal Products Corp., 91 Clay, North East, Pa. . . . . W S H . .
Fiess Carbon Co., 508 Broome, New York C . . . .
General Electric Co., Schenectady, N. Y. . . . C . . . . H
Graphalloy. See Graphite Metallizing Corp.
Graphite Metallizing Corp., 1040 Nepperhan Ave., Yonkers, N. Y. . . . . C . . . . H . .
Henrite Products Co., 98 Park Place, New York, N. Y. C
Holland Trolley Supply Co., 1623 E. 43rd, Cleveland, Ohio . . . . . H . .
Jeandron, W. J., 345 Madison Ave., New York, N. Y. (Imported.) . . . . . C . . . . .
Keystone Carbon Co., 4630 N. 11th, Philadelphia, Pa. C
Kohlenite Products Co., 92-34 152nd St., Jamaica, N. Y. C
Le Carbone. See Jeandron, W. J.
Le Valley Vitae Carbon Brush Co., 4851 Grand Central Terminal, New York, N. Y. C
Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich. C
Morganite Brush Co., 33-02 48th Ave., Long Island City, N. Y. C
National Carbon Co., Cleveland, O. C
New Process Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. . . . . C L
No Spark. See Calebaugh Self-Lubricating.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, Ohio . . . . . C W L
Ohio Elec. Specialty Mfg. Co., Troy, O. . . . W
Perfection Supply Co., 98 Park Pl., New York, N. Y. . . . . C W S H L
Pittsburgh Carbon Brush Co., 127 Fancourt, Pittsburgh, Pa. C
Pure Carbon Co., Wellsville, N. Y. . . . . C W S . . L
Pyramid. See National Carbon Co.
Reaction. See Baylis Co.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y. . . . . W L
Salem Electrical Supply Co., Salem, Mass. . . W . . . .
Smarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. C
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y. . . . . C L
Speer Carbon Co., St. Mary's, Pa. C
Stackpole Carbon Co., St. Mary's, Pa. . . . C
Sterling. See Carbon Laboratories Co.
Superior Carbon Products Co., North Rd., Poughkeepsie, N. Y. C
U. S. Graphite Co., Saginaw, Mich. C
Universal. See Graphite Metalizing Corp.
Weber Elec. Wks., Brooklyn Sta., Cleveland. C L
BRUSHES, PNEUMATIC SPRAYING. See Spraying Outfits.

BRUSHES FOR VACUUM CLEANERS

Omaha Brush Co., 320 N. 15th, Omaha, Neb. (Brushes rebristled.)
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
BUGGIES, Armature. See Lifts, Armature.

BULBS, Glass

For Incandescent Lamps and Tubes.
Almo Mfg. Co., 38 Crawford, Newark, N. J.
Corning Glass Wks., Corning, N. Y.
Fayette Glass Bulb Co., 229 21st, Brooklyn, N. Y.
Libby Glass Co., Toledo, O.
BUNCHING MACHINES. See Wire Manufacturing Machines.
BUSHINGS, SHAFT. See Bearings and Bushings.

BUSHINGS, Box and Cabinet, Porcelain

Appleton Electric Co., 1704 Wellington Ave., Chicago, Ill.
Columbia Metal Box Co., 226 E. 144th St., New York, N. Y.
Harter. See Multi Elecl. Mfg. Co.
Knox Porcelain Corp., Knoxville, Tenn.
Mineraliac Electric Co., 25 N. Peoria, Chicago, Ill.
Multi Electric Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Nelson Elec. Co., Plant City, Fla.
CABINET GRILL CLOTH. See Cloth, Untreated.

CABINETS, Fibre

Continental-Diamond Fibre Co., Bridgeport, Pa.
Vulcawood. See Continental-Diamond Fibre Co.
CABINETS. Refrigerator. See Refrigerator Cabinets.

CABINETS, Sheet Steel

Stamped and Turned-up Boxes and Cabinets.
Acme Blow Pipe & Sheet Metal Wks., New Orleans, La.

Adam Electric Co., Frank, St. Louis, Mo.
All-Steel-Equip. Co., Aurora, Ill.
American Metal Wks., 4868 Stanton Ave., Philadelphia, Pa.
American Steel Furniture Co., 27 W. 24th, New York, N. Y.
Aurora Steel Products Co., Aurora, Ill.
Benjamin Elec. Co., 1378 E. 16th, Los Angeles, Cal.
Berks Engineering Co., Reading, Pa.
Berthold Elec. Co., Gus, 551 W. Monroe, Chicago, Ill.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Chicago Hdwe. Foundry Co., North Chicago, Ill.
C. & P. Electric Wks., Springfield, Mass.
Cleveland Switchboard Co., 2925 E. 79th, Cleveland, O.
Coast Specialty Co., 73 E. Sixth, Portland, Ore.
Cole Metal Products Co., 33 Crescent, Long Island City.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Elec. Mfg. Co., 59 Columbus Sq., San Francisco, Cal.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Columbian Steel Tank Co., 1505 W. 12th, Kansas City, Mo
Commercial Mfg. & Supply Co., 1443 Delaware St., Denver.
Creiger Electrical Mfg. Co., 609 W. Lake, Chicago, Ill.
Diamond Elec'l Mfg. Co., 1330 E. 16th, Los Angeles, Cal.
Dowman-Dozier Mfg. Co., 1314 Murphy Ave., S. W., Atlanta, Ga.
Electric Apparatus Co., 704 N. Halsted, Chicago, Ill.
Electric Panelboard Co., 426 Exchange, Rochester, N. Y.
Federal Steel Products Co., 2 Ave. L, Newark, N. J. (Polarized Boxes.)
Fouch Elec. Mfg. Co., 105 N. Ninth, Portland, Ore.
Greater New York Metal Box Co., Inc., 143 W. 19th, New York.
Green Elec. Co., 31 N. Water, Rochester, N. Y.
Gurney Sheet Metal Wks., 718 E. 4th, Long Beach, Cal.
Hauer, J. B., Driggs Ave. and N. 11th, Brooklyn, N. Y.
Holzer Sheet Metal Wks., Inc., New Orleans, La.
Hough Mfg. Co., 2520 24th, Detroit, Mich.
Isert Co., J. H., 1234 Rowan, Louisville, Ky.
Karp Metal Products Co., 129 30th, Brooklyn, N. Y.
Kirtland Elec. Construction Co., 54 Herkimer, Albany, N. Y.
Largo-Dall Mfg. Co., 606 Cherry St., Philadelphia.
Leonard Elec. Mfg. Co., 2327 Perkins Ave., Cleveland, O.
Lexington Elec. Products Co., 419 E. 24th, New York, N. Y.
Lorentzen, H. K., 155 Leonard, New York, N. Y.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Mansfield Elec. Hardware Co., Longview Ave., Mansfield, O.
Metropolitan Elec. Co., 2914 First Ave., S., Seattle, Wash.
Metropolitan Elec. Products Co., Blvd. at 14th, Long Island City, N. Y.
Milwaukee Vault & Cabinet Co., 521 Market, Milwaukee.
Mosher, S. L., 1951 Lawrence, Denver, Colo.
National Metal Box Co., Van Dyke & Ferris Sts., Brooklyn.
Newman Elec. & Mfg. Co., Eau Claire, Wis.
Par-Metal Products Corp., 3519 41st, Long Island City, N. Y.
Penn Electrical Co., 35 Water, Irwin, Pa.
Powerlite Switchboard Co., 4149 E. 79th, Cleveland, O.
Reznlon. See Holzer Sheet Metal Works.
Robbins & Myers, Inc., Springfield, O.
Security. See Aurora Steel Products Co.
Standard Metal Box Corp., 950 Grand St., Brooklyn, N. Y.
Star Metal Box Co., 238 46th, Brooklyn, N. Y.
Superior Switchboard & Devices Co., 420 Schroyer Ave., Canton, O.
Tanner & Co., Wm. F., 511 S. Sharp, Baltimore, Md.
United Metal Box Co., 473 President, Brooklyn, N. Y.
United Sheet Metal Wks., 575 Howard, San Francisco.
Universal Metal Box & Products Co., 316 Colt, Irvington N. J.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Wiegman & Co., E. M., 1908 Benton, St. Louis, Mo.
Wurdack Elec. Mfg. Co., 4444 Clayton Ave., St. Louis, Mo.

CABINETS AND BOXES, Wood

Accurate Molding Corp., 20 Morton, Brooklyn, N. Y.
Adler Mfg. Co., Louisville, Ky.
Adler Royal. See Adler Mfg. Co.
Ampere. See Donehue Lumber Co.
Art Woodworking Co., Inc., 1035 Seattle Blvd., Seattle, Wash.
Aston Cabinet Mfrs., 1223 W. Lake, Chicago, Ill.
Boehm Cabinet Co., J., 3216 W. 63rd St., Cleveland, O.
Carlon. See Art Woodworking Co.
Carolina Wood Products Co., Asheville, N. C.
Carrom Co., Ludington, Mich.
Caswell-Runyon Co., Huntington, Ind.
Cheney Piano Action Co., A. C., Castleton, N. Y.
Chickasaw Furniture Mfg. Co., Memphis, Tenn.
Clinton Corp., 342 Madison Ave., New York, N. Y.
Conrades Mfg. Co., 1942 N. Second, St. Louis, Mo.
Corrietta Cabinet Mfg. Co., St. Mary's, Pa.
Cory Cabinet Corp., Springfield, Mo.
Deiker Co., Geo., Henderson, Ky.
Ebert Furniture Co., 225 W. 34th, New York, N. Y.
Efein & Sons, Frederick, 44 Central Ave., Brooklyn, N. Y.
Empire-United Hat Block Co., 312 E. 22nd, New York.
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Excel Phonograph Mfg. Co., 400 W. Erie, Chicago, Ill.
Excello Products Corp., 4836 W. 16th, Cicero, Ill.
Federal Wood Products Corp., 206 Lexington Ave., New York, N. Y.
Findlay Mfg. Co., Metropolitan & Morgan Aves., Brooklyn.
Grand Rapids Furniture Co., Grand Rapids, Mich.
Harper Mfg. Co., Cassopolis, Mich.
Hickory Box Co., Hickory, N. C.
Hubbell, H. L., 59 Market Ave., N. W., Grand Rapids.
Interstate Woodworking Co., 46 Wooster, New York, N. Y.
Karpen. See Studner Bros.
King Mfg. Corp., 254 Rano, Buffalo, N. Y.
Klumpp Sons, John G., 18 Baxter, New York, N. Y.
Knoxville Table & Chair Co., Knoxville, Tenn.
National Cabinet Co., New Philadelphia, O.
New England Box Co., Greenfield, Mass.
Ohio Valley Cabinet Co., Wheeling (Warwood), W. Va.
Oneida Cabinet Corp., Oneida, N. Y.
Ottawa Furniture Co., Holland, Mich.
Pooley Co., 16th & Indiana Ave., Philadelphia, Pa.
Radio Allied Mfrs. Corp., 1340 S. Michigan Ave., Chicago.

Radio Cabinet Mfg. Corp., Furniture Mart, Chicago, Ill.
Radio Cabinet & Equipment Co., 1504 Vine, Philadelphia.
Radio Mfg. Co., Div. of Pillied Lumber Co., Swanton, O
Radio Master Corp., Bay City, Mich.
Red Lion Cabinet Co., Red Lion, Pa.
R E. Z. Cabinet Co., 54 North, Boston, Mass.
Rockford Sales Corp., 206 Lexington Ave., New York, N. Y.
Schutz Bros., 152 Chambers, New York, N. Y.
Showers Bros. Co., Bloomington, Ind.
Signal Elec. Mfg. Co., Menominee, Mich.
Southern Toy Co., Hickory, N. C.
Specialty Display Case Co., Kendallville, Ind.
Starr Piano Co., Richmond, Ind.
Stettner Phonograph Corp., 669 Kent Ave., Brooklyn, N. Y.
Studner Bros., 67 W. 44th, New York, N. Y.
Superior Cabinet Corp., 206 Broadway, New York, N. Y.
Syracuse Screen & Grille Co., North Manchester, Ind.
Tessier Bros., 355 Bridge, Northampton, Mass. (Radio.)
Trenton Wood Specialty Co., Stokes Ave. and P. R. R., Trenton, N. J.
Udell Wks., 28th and Barnes Ave., Indianapolis, Ind.
United Reproducers Corp., 25 Leighton Ave., Rochester, N. Y.
West Box Co., 235 Liberty, Springfield, Mass
Wood Cabinet Corp., 196 Lexington Ave., New York,, N. Y.
CABLE ARMORING MACHINES. See Wire Manufacturing Machines
CABLE TEST SETS. See Instruments, Portable and Switchboard.
CABLING MACHINES. See Wire Manufacturing Machines

CANDLES, Fixture

Glass, Fibre Paper.
Brandywine Fibre Products Co., 1402 Walnut, Wilmington.
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Fibro Products Co., New Bedford, Mass.
Franklin Fibre Specialty Co., 173 Lafayette, New York, N.Y
Phoenix Glass Co., Monaca, Pa.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Seamless. See Fibre Products Co.
CANOPY (Canopies). See Fixture Fittings.
Insulators. See Insulators.
Switches. See Switches, Snap.
CAPACITORS, RADIO. See Radio Circuit Components.

CARBON, Powdered

Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich
CARBONS, Battery. See Carbons.
Arc Light. See Carbons.

CARBONS

Battery Arc Light.
Becker Bros. Elecl. Corp., 23 N. Jefferson, Chicago, Ill
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.
Columbia. See National Carbon Co.
Daylight. See National Carbon Co.
Lessing Battery. See Blanck & Carrier Corp.
Nuernberg Battery. See Blanck & Carrier Corp.
National Carbon Co., Cleveland, Ohio.
Oretip. See National Carbon Co.
Silvertip. See National Carbon Co.
Speer Carbon Co., St. Mary's, Pa.
Stackpole Carbon Co., St. Mary's, Pa.
CARTONS. See Boxes and Wrappers.
CASEIN PLASTICS. See Molded Insulation.
CASES, Eliminator. See Cases, Eliminator.
Flashlight. See Cases, Flashlight.

CASES, Eliminator

Brumberger Co., 252 Pearl, New York, N. Y.
Grand Sheet Metal Wks., 176 Grand, New York, N. Y.
Karp Metal Products Co., 129 30th, Brooklyn.

CASES, Flashlight

Bridgeport Brass Co., 744 E. Main, Bridgeport, Conn.
Lincoln Fibre Specialty Co., Newport, Del.
St. Louis Paper Can & Tube Co., St. Louis, Mo.
Underwood Battery Co., 1250 Ontario, Cleveland, O.
CASTINGS, Aluminum. See Castings, Aluminum. Also Castings, Copper, etc.
Brass. See Castings.
Bronze. See Castings.
Copper. See Castings.
Die. See Castings, Die.
Monel Metal. See Castings.
Steel. See Castings, Steel.
White Metal. See Castings.

CASTINGS, Aluminum

Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Berks Foundry & Mfg. Co., West Hamberg, Pa.
Bohm Aluminum & Brass Corp., Detroit, Mich.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y
Dick Bros., Inc., Reading, Pa.
Eureka Metal Products Corp., 91 Clay, North East, Pa.
Monarch Aluminum Ware Co., 9301 Detroit Ave., Cleveland.
National Bronze & Aluminum Foundry Co., 88th & Lake, Cleveland O.
Quality Aluminum Casting Co., Waukesha, Wis.
Tenual. See National Bronze & Aluminum Foundry Co.
Veco Mfg. Co., South Norwalk, Conn.

CASTINGS

Copper, Brass, Bronze, Monel Metal, White Metal.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass
Berks Foundry & Mfg. Co., West Hamberg, Pa.
Bohn Aluminum & Brass Corp., Detroit.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y
Bridgeport Castings Co., 250 North Ave., Bridgeport, Conn
Central Pattern & Foundry Co., 3737 S. Sacramento Ave. Chicago, Ill.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Hardware Foundry Co., North Chicago, Ill.
Delta Star Electric Co., 2437 Fulton, Chicago, Ill.
Dick Bros., Inc., Reading, Pa.
Eureka Metal Products Corp., 91 Clay, North East, Pa.
Faries Mfg. Co Decatur, Ill.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit.
Harsch, John, Bronze & Foundry Co., 11612 Madison Ave., Cleveland, O.

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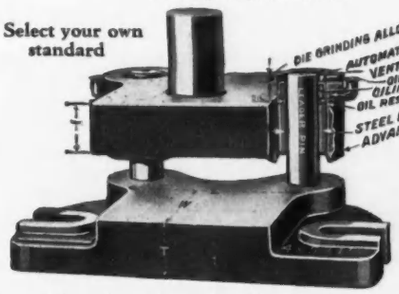

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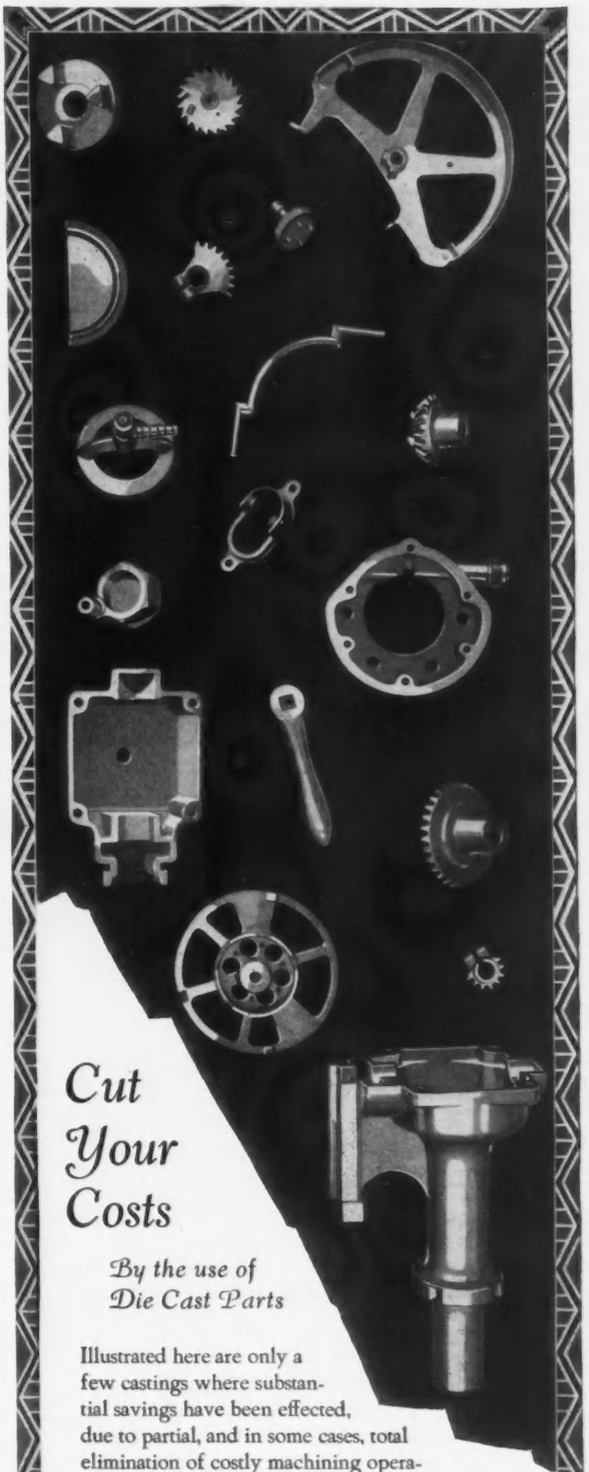

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National Bronze & Aluminum Foundry Co., 88th & Lazy, Cleveland, O.
Ohio Pattern Wks. & Fdy. Co., 2730 Spring Grove Ave Cincinnati, O.
Rabun Bronze Foundry, 617 West Belgrave, Huntington Park, Cal.
Sterling Art Metal Wks., 40 Purvis, Long Island City, N. Y
Tenual. See National Bronze & Aluminum Foundry Co.

CASTINGS, Die

Advance Tool & Die Casting Co., 1654 Holton, Milwaukee, Wis.
Alemite Die-Casting & Mfg. Co., 2640 Belmont Ave., Chicago, Ill.
Allied Die-Casting Corp., Long Island City, N. Y.
Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Aluminum Industries, Inc., 2438 Beekman, Cincinnati, O.
American Brass Co., Waterbury, Conn.
Anaconda. See American Brass Co.
American Die Casting Co., 2040 Dominick, Chicago, Ill.
Badger Die Casting Co., 156 East Buffalo, Milwaukee, Wis.
Barnhardt Bros. & Spindler, Monroe & Throop St., Chicago.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.
Do-Di. See Doehler Die Casting Co.
Doehler Die Casting Co., 386 Fourth Ave., New York, N. Y.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit,
Franklin Die Casting Corp., 828 Gifford, Syracuse, N. Y.
Illinois Die Castings Co., 551 W. Congress, Chicago, Ill.
Krone-Seebek Die Casting & Mfg. Co., 2935 W. 47th, Chicago, Ill.
Milwaukee Die Casting Co., 289 Fourth, Milwaukee, Wis.
Newton Die Casting Corp., 146 Munson, New Haven, Conn.
Paragon Die Casting Co., 2701 N. Crawford Ave., Chicago.
Perfection Die Casting Corp., 406 Lakeside Ave., N. W., Cleveland, O.
Permite. See Aluminum Industries, Inc.
Phoenix Die Castings Co., 21 Illinois, Buffalo, N. Y.
Stewart Die Casting Co., 4500 Fullerton Ave., Chicago, Ill.
Superior Die Casting Co., 875 E. 70th, Cleveland, Ohio.
Twin City Die Castings Co., Talmadge and 33rd Aves., S. E., Minneapolis, Minn. (White Metal).

CASTINGS, Gray Iron

American Engineering Co., Philadelphia, Pa.
Athens Foundry Co., Athens, Pa.
Barlow Foundry Co., 551 N. J. R. R. Ave., Newark, N. J.
Barnett Foundry Co., Newark, N. J.
Berks Foundry & Mfg. Co., West Hamberg, Pa.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Bridgeport Castings Co., 250 North Ave., Bridgeport, Conn.
Chicago Hardware Foundry Co., North Chicago, Ill.
Dick Bros., Inc., Reading, Pa.
Eastern Malleable Iron Co., Naugatuck, Conn.
Fairmount Foundry, Inc., Third & Westmoreland Sts., Philadelphia, Pa.
Forest City-Walworth Run Fuondries Co., 2500 W. 27th, Cleveland, O.
Gray Iron Foundry Co., Reading, Pa.
Milwaukee Grey Iron Foundry Co., 3910 Mitchell, Milwaukee, Wis.
North Lebanon Foundry Co., Second & Canal, Lebanon, Pa.
North Wales Mach. Foundry Co., North Wales, Pa.
Products Machine Co., Bridgeport, Conn.
Sacks Iron Foundry, L., 357 Wilson Ave., Newark, N. J.
Snead & Co., Pine St., Jersey City, N. J.
St. Louis Malleable Castings Co., 7701 N. Conduit Ave., St. Louis, Mo.
Union Mfg. Co., New Britain, Conn.
Western Foundry Co., Kedzie Ave. at 36th, Chicago, Ill.

CASTINGS, Steel

Bonney-Floyd Co., Columbus, Ohio.
Eastern Steel Casting Co., Ave. L & Edward St., Newark.
Northwestern Steel & Iron Corp., 2907 Fourth, S. E., Minneapolis, Minn.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Procisn. See Northwestern Steel & Iron Corp.
Riverside Steel Casting Co., Jacobus Ave., Kearney, N. J

CEMENT, Commutator

Anchorlute. See Technical Products Co.
Commutator Companion. See Withington Div. of Marmot Co.
Conductalute. See Technical Products Co.
Early, Edward E., 1129 W. Fifth, N. W., Canton, O.
Fixkwick. See Technical Products Co.
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Mitchell Rand Mfg. Co., 19 Vesey, New York, N. Y.
Perce-Lute. See Perfection Supply Co.
Perfection Supply Co., 98 Park Pl., New York, N. Y.
Plas Mica Co., 26 St. Andrews Place, Yonkers, N. Y.
Technical Products Co., 116 S. Sheridan Sq., Pittsburgh, Pa
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa
Withington Div. of Marmot Co., 50 Thayer, Boston, Mass.

CEMENT, Liquid Porcelain

Anchorlute. See Technical Products Co.
Fire Lute. See Technical Products Co.
Insa-Lute. See Technical Products Co.
Okonite Co., Passaic, N. J.
Patch-O-Namel. See Technical Products Co.
Repairet Mfg. Co., Milwaukee, Wis.
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa
Thermoid. See Technical Products Co.
CHAIN, Chandelier (Fancy). See Crystals, Chandelier
CHAIN DRIVES. See Chain, Power Transmission

CHAIN, Fixture

Acco. See American Chain Co.
American Chain Co., Bridgeport, Conn.
Chase Brass & Copper Co.
Eastern Chain Works, 309 E. 22nd St., New York, N. Y

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H. & O. Chain Co., So. Norwalk, Conn.
Newark Metal Mfg. Co., 22 S. 6th, Newark, N. J.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rodale Mfg. Co., 280 Hudson, New York, N. Y.
Steele & Johnson Mfg. Co., Waterbury, Conn.
Universal Metal Chain Co., 75 Clymer, Brooklyn, N. Y.

CHAIN, Power Transmission

Baldwin Chain & Mfg. Co., Worcester, Mass.

Boston Gear Wks. Sales Co., Norfolk Downs, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Company, 910 S. Michigan Ave., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Reeves Pulley Co., Columbus, Ind.
Renold Boston. See Boston Gear Wks.
Union Chain & Mfg. Co., Sandusky, O.
Whitney Mfg. Co., Hartford, Conn.

CHAIN, Socket

American Ball Chain Works, 12 Worcester St., New York.
Bead Chain Mfg. Co., Bridgeport, Conn.
H. & O. Chain Co., South Norwalk, Conn.
CHANDELIER BEADS. See Crystals, Chandelier.
CHANDELIER CRYSTALS. See Crystals, Chandelier.
CHANDELIER FRINGE. See Crystals, Chandelier.

CHARGERS, Magnet

Charging, Remagnetizing.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Cowie Elec. Co., E. S., 1823 Wyandotte, Kansas City, Mo.
Fore Elec. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.
Scintilla Magneto Co., Inc., Sidney, N. Y.
Serrwell Sales Corp., 1749 N. Winchester Ave., Chicago.
Valley Electric Co., 4221 Forest Park Blvd., St. Louis, Mo.

CHEMICALS, Battery

Electrolyte, Battery Salts, Battery Oxides, Sal Ammoniac, Bluestone, Manganese.
Cooper & Co., Charles, 194 Worth, New York, N. Y.
Eagle-Picher Lead Co., 134 N. LaSalle, Chicago. (Oxide.)
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Electro Chemical Co., 113 W. Court St., Dayton, O.
General Metallic Oxides Co., Jersey City, N. J.
Globe Chemical Co., Murray Rd. and Big Four R. R., Cincinnati, O.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Kalbfleisch Corp., 200 5th Ave., New York, N. Y.
Klipstein Co., 644 Greenwich, New York, N. Y.
Merrimac Chemical Co., 148 State, Boston, Mass.
Powers-Weightman-Rosengarten Co., Philadelphia, Pa.
Voltah. See Powers-Weightman-Rosengarten Co.
Wah Chang Trading Corp., 233 Broadway, New York, N. Y.

CHEMICALS, Refrigeration

Ansul Chemical Co., Marinette, Wis.
Arctic. See Roessler & Hasslacher Chemical Co.
Carbide & Carbon Chemicals Corp., 30 E. 42nd, New York, N. Y. (Butane & Isobutane.)
Dry Ice Corp. of America, 50 E. 42nd, New York, N. Y.
Roessler & Hasslacher Chemical Co., 709 Sixth Ave., New York, N. Y. (Methyl Chloride, Ethyl Chloride.)
Virginia Smelting Co., West Norfolk, Va. (Sulphur Dioxide.)
Chromium Plating. See Plating & Finishing.

CHUCKS, Magnetic

J & H Elec. Co., 161 Clifford, Providence, R. I.
Simmons. See Taft-Pierce Mfg. Co.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S. (Rockdale), Worcester, Mass.

CIRCUIT BREAKERS

Air and Oil Circuit Breakers and Oil Break Switches.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Anderson Mfg Co., Albert & J. M., 289 A, Boston, Mass.
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Automatic Switch Co., 517 E. Larned, Detroit, Mich.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cramblett Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn.
Hart & Hegeman Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Hartman Electrical Mfg. Co., 31 E. Fifth, Mansfield, Ohio.
High Tension Elecl. Specialty Co., 500 Washington, Abington, Mass.
Hi-teco. See High Tension Elecl. Specialty Co
H. & H. See Hart & Hegeman Div.
Inducto-therm. See Allen-Bradley Co.

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Line Material Co., South Milwaukee, Wis. (Oil Switches.)
Maple Co., R. H., Indianapolis, Ind.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Minibraker. See Burke Controller Co.
Moller-Smith Co., 239 Broadway, New York, N. Y.
Sentinel. See Westinghouse Elec. & Mfg. Co.
Takanine Corp., 208 Rawson, Long Island City, N. Y.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam.
U-Re-Lite. See I. T. E. Circuit Breaker Co
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa
CIRCUIT TESTERS. See Testers, Fuse and Circuit
CLEANER BAGS, Vacuum. See Bags, Vacuum Cleaner
CLEANER BRUSHES, Vacuum. See Brushes for Vacuum Cleaners.

CLEANERS, Metal

Oakite Products, Inc., 26 Thames, New York, N. Y.
CLIPS, Fuse. See Fuse Clips.

CLIPS, Heater Plug

Gray Bros. Co., Plano, Ill.
CLOCK SWITCHES. See Switches, Time.
CLOTH GEARS. See Gears and Pinions, Composition.
CLOTH LOUD SPEAKER DIAPHRAGM. See Cloth, Untreated.
CLOTH RADIO GRILL. See Cloth, Untreated.

CLOTH, Untreated

Doyle & Co., John, 112 Duane, New York, N. Y.
Canvas, "Aeroplane Cloth," Cotton Duck, Drill, Diaphragm Cloth, Grill Fabrics, etc
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pindall Fabrics Corp., 200 Madison Ave., New York, N. Y. (Grill Cloth).

CLOTH AND PAPER, Insulating

Cloth, Insulated .....See C
Paper, Insulated .....See P
Fibre Paper (Fish Paper) .....See F
Press Board (Fuller Board)....See B
Silk .....See S

Acme Wire Co., New Haven, Conn..... C S P . . .
Armco. See Rogers Paper Mfg. Co.
Armatite. See Mica Insulator Co.
Brand & Co., William, 268 4th Ave., New York..... P . . .
Campbellite. See National Vulcanized Fibre Co.
Carboloid Products Corp., 15 Park Row, New York, N. Y..... C . . P . . .
Case Brothers, Inc., Highland, Park, Conn. . . . . P . . B
Case Mfg. Co., Unionville, Conn..... P . . .
Case & Risley Press Paper Co., Oneco, Conn. . . . . P . . .
Celoron Co., Bridgeport, Pa..... P F B
C-F. See National Vulcanized Fibre Co.
Chicago Mica Co., 345 Campbell, Valparaiso, Ind. ..... C . . . . .
Columbian Rope Co., Auburn, N. Y..... P . . .
Continental-Diamond Fibre Co., Bridgeport, Pa. ..... P . . .
De Jonge & Co., Louis, 69 Duane, New York, N. Y. (Condenser)..... P . . .
Dexstar. See Dexter & Sons.
Dexter & Sons, C. H., Windsor Locks, Conn. (Condenser Tissue.)
Dielectric Mfg. Co., St. Louis, Mo..... C S P . . B
Electrite. See West Virginia Pulp & Paper Co.
Fyberoid. See Wilmington Fibre Specialty Co.
General Electric Co., Merchandise Dept., Bridgeport, Conn. ..... C . . P . . .
chandise Dept., Bridgeport, Conn..... C . . P . . .
Hartford City Paper Co., Hartford City, Ind. (Glassine Condenser Tissue).
Hewitt & Bros., C. B., 16 Ferry, New York C . . P . . .
Hi-Tex. See Stevens Paper Mills.
Incella. See Tarentum Paper Mills Co.
Irvington Varnish & Insulator Co., Irvington, N. J. ..... C S P . . .
Manning Paper Co., J. A., Troy, N. Y..... B
Mica Insulator Co., 200 Varick, New York C S P . . B
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. ..... P . . .
National Vulcanized Fibre Co., Wilmington, Del. ..... F . .
New Jersey Wood Finishing Co., Woodbridge, N. J. ..... C . . . . .
Ohmoid. See Wilmington Fibre Specialty Co.
Old Hick. See Hewitt & Bros., C. B.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 310 Lincoln, Boston, Mass. . . . . F . .
Rogers Paper Mfg. Co., South Manchester, Conn. ..... B
Schweitzer, Inc., Peter J., 200 Fifth Ave., New York, N. Y. (Condenser Tissue.)
Sico. See Standard Insulation Co.
Standard Insulation Co., East Rutherford, N. J. ..... C S P . . .
Sterling Fireboard Co., 501 Fifth Ave., New York. (Varnished Hard Fibreboard)..... B
Sterlite. See Sterling Firebrand Co.
Stevens Paper Mills, Windsor, Conn..... B
Tarentum Paper Mills Co., Tarentum, Pa..... P . . .
Turbenite. See Brand & Co., Wm.
Union Mills Paper Mfg. Co., New Hope, Pa. . . . . P . . .
Warren Mfg. Co., 342 Madison Ave., New York, N. Y. ..... P . . .
West Virginia Pulp & Paper Co., 230 Park Ave., New York..... B
Wilmington Fibre Specialty Co., Wilmington, Del. ..... P . . .

CLUTCHES, Magnetic

Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.

COIL (Coils).

Armature and Field. See Coils, Finished.
Choke (Power). See Fittings, High Tension.
Choke (Radio). See Radio Circuit Components.
Driers & Impregnators. See Ovens.

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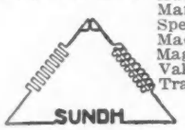
Valves, Magnet Operated
Transfer Switches


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COIL (Coils)—Continued
Electromagnet. See Coils, Finished.
Flatteners. See Rolls, Coil Flattening.
High Frequency. See Electro-Therapeutic; also Radio Circuit Components; also Ignition Outfits.
Impregnators, Vacuum. See Ovens, Industrial.
Induction. See Coils, Finished; also Electro-Therapeutic.
Loop Benders. See Benders, Coil Loop.
Medical. See Electro-Therapeutic.
Presses. See Presses, Armature Coil.
Radio. See Radio Circuit Components.
Removers. See Removers, Coil.
Resistance. See Units, Rods & Grids; also Radio Circuit Components.
Shaping Machines. See Shaping Machines, Coil.
Spark. See Ignition Outfits.
Spreaders. See Winding Machines, Armature & Field Coil.
Tamping Tools. See Tools, Coil Tamping.
Taping Machines. See Taping Machines, Coil.
Testers. See Testers, Coil; also Test Benches, Armature
Winders, Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Winders, Induction Coil. See Winding Machines, Industrial Coil.
Winding Forms. See Forms, Coil Winding.
Windings (Magneto). See Coils, Finished.
Wire Tension Devices. See Tension Devices, Coil Wire

COILS, Finished
Armature, Field, Electromagnet and Induction Coils.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero-Call. See Aero Products, Inc.
Aero Products, Inc., 4611 Ravenswood Ave., Chicago, Ill.
Auth Electrical Specialty Co., 422 E. 53rd St., New York.
A. & A. See Electrical Coil Winding Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Bunnell & Co., J. H., 32 Park Place, New York, N. Y.
Burke Controller Co., 389 Lexington Ave., New York, N. Y.
Cameron Elec. Mfg. Co., Ansonia, Conn.
Coto Coil Div. of Universal Winding Co., Providence, R. I.
Ditmar Elec. Co., Brookline, Mass.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.
Easton Coil Co., Easton, Pa.
Electric Heat Control Co., 5905 Carnegie Ave., Cleveland, O.
Electric Valve Mfg. Co., 68 Murray, New York, N. Y.
Electrical Coil Winding Co., 2735 Saunders, Camden.
Electrical Products Mfg. Co., Providence, R. I.
Fredericks Co., H. M., Lock Haven, Pa.
Globe Technolian Corp., Reading, Mass.
Herald Electric Co., 29 East End Ave., New York, N. Y.
Marion Elec. Mfg. Co., 24 Cliff, Jersey City, N. J.
Modern Elec Mfg. Co., 312 Mulberry, Toledo, Ohio.
National Elec. Corp., 226 High, Newark, N. J.
Pifer Elec. Repair & Mfg. Co., 3610 Superior Ave., Cleveland, O.
Polymet Mfg. Co., 829 E. 134th St., New York, N. Y.
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Robertson, Leo F., Inc., 532 West 22nd St., New York, N. Y.
Rome Wire Co. (Div. of General Cable Corp.), Rome, N. Y.
Sernson Magneto Engrg. Co., 397 Phillips, Toledo, O.
Stuns & Barron, 210 E. Pratt, Baltimore, Md.
Toledo Standard Commutator Co., 2242 Smead Ave., Toledo, O.
Varley Duplex Magnet Co., 15 Exchange Place, Jersey City, N. J. (Electromagnetic only).

COMMUTATOR
Bars. See Bars, Commutator.
Cement. See Cement, Commutator.
Dressers. See Stones, Commutator.
Lubricants. See Compounds, Commutator.
New. See Commutators.
Refilled. See Repairing and Second Hand.
Slotters. See Slotting Machines & Tools, Commutator
Slotting Files. See Files, Commutator Slotting.
Soldering Machines. See Soldering Machines, Commutator
Stones. See Stones, Commutator.
Tighteners. See Tighteners, Commutator.
Truing Devices. See Tools, Commutator Truing.

COMMUTATORS
Derby Commutator Co., Derby, Conn.
Electric Materials Co., North East, Pa.
Eureka Metal Products Corp., 91 Clay, North East, Pa.
Homer Commutator Co., Cleveland, Ohio.
COMMUTATOR BRUSHES. See Brushes, Commutator.
COMPOSITION PULLEYS. See Pulleys, Composition.
COMPOUNDS, Sealing. See Wax and Compounds.

CONDENSER UNITS, Refrigerator
Bush Mfg. Co., Hartford, Conn.
McCord Radiator & Mfg. Co., Riorelle & E. Grand Ave., Detroit, Mich.
Rome-Turney Radiator Co., Rome, N. Y.
CONDENSERS, Radio. See Radio Circuit Components.
CONDENSER TUBING. See Tubing, Brass and Copper.

CONNECTORS, Pin-Plug
Kliegl Bros. Universal Electric Stage Ltg. Co., 321 W. 50th, New York, N. Y.

CONNECTORS, Wire
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill. (Solderless-Tapeless).
CONTACT POINTS. See Points, Contact.
CONTAINERS, Shipping. See Fibre Board Products.

CONTROLLERS, Motor
Allen-Bradley Co., 484 Reed, Milwaukee, Wis.
Anderson & Co., C. J., 53 W. Jackson Blvd., Chicago, Ill.
Automatic Switch Co., 154 Grand, New York, N. Y.
Betts, Inc., James H., 1393 Sedgwick Ave., New York, N. Y. (Traffic.)
Burke Controller Co., 389 Lexington Ave., New York, N. Y.
B-G Oil Burner Co., Stockton, Cal.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Condit Elec'l Mfg. Corp., 855 Summer St. (South Boston), Boston, Mass.

Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Diamond Elecl. Mfg. Co., 1330 N. 16th, Los Angeles, Cal.
Dinkey. See Elec. Controller & Mfg. Co.
E C & M Youngstown. See Electric Controller & Mfg. Co.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electrite. See Sundh Elec. Co.
General Electric Co., Schenectady, N. Y.
Horni Signal Mfg. Corp., 515 Greenwich, New York.
Industrial Controller Div. of Square D Co., S. Pierce & Hanover, Milwaukee, Wis.
Maimin Speed Control Corp., 251 W. 19th, New York. (Sewing Machines.)
Monitor Controller Co., 51 Gay, Baltimore, Md.
National Electric Controller Co., 5315 Ravenswood Ave., Chicago, Ill.
Refrigerating Specialties Co., 728 S. Sacramento Blvd., Chicago, Ill.
Resisto. See Allen-Bradley Co.
Rowan Controller Co., 306 N. Holliday, Baltimore, Md.
Square D Co., 6060 Rivard, Detroit, Mich.
Sundh Elec. Co., Parkhurst St. at Ave. C, Newark, N. J.
Switchotone. See Condit Elec. Mfg. Co.
Thermaload. See Monitor Controller Co.
Trumbull Electric Mfg. Co., Plainville, Conn.
Uemco. See Union Elec. Mfg. Co.
Unelco. See Union Elec. Mfg. Co.
Union Elec. Mfg. Co., 934 Juneau Ave., Milwaukee, Wis.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
W. K. See Westinghouse Elec. & Mfg. Co.
COPPER. See Brass, Bronze and Copper; also Castings.
COPPER TUBING. See Tubing, Brass and Copper
CORD TIPS. See Tips, Cord.
CORD, Tinsel. See Tinsel Cord & Thread.

CORDS, Extension
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.

CORES, RESISTANCE COIL (Lava)
American Lava Corp., 1425 William, Chattanooga, Tenn.
Crescent. See M. Kirchberger & Co.
Es-El-Co. See Southern Lava Co.
Kirchberger & Co., M., 1425 37th, Brooklyn, N. Y.
Lavite. See Steward Mfg. Co.
Lavarock. See M. Kirchberger & Co.
Southern Lava Co., Rossville, Ga.
Steward Mfg. Co., D. M., Chattanooga, Tenn.
Tennessee Burner Mfg. Co., Chattanooga, Tenn.
XL. See Tennessee Burner Mfg. Co.

CORES, RESISTANCE COIL (Refractory Porcelain)
American Lava Corp., 1425 William, Chattanooga, Tenn.
Colonial Insulator Co., Akron, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Elemite. See Louthan Mfg. Co.
Firelite. See Hartford Faience Co.
Hartford Faience Co., Hartford, Conn.
Louthan Mfg. Co., E. Liverpool, O.
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.
Thermal Syndicate, 58 Schenectady Ave., Brooklyn, N. Y.
Vitreosil. See Thermal Syndicate.
Woolley, Inc., W. Douglas, East Liverpool, O.
COTTON DUCK. See Cloth, Untreated.
COTTON SLEEVING. See Tape, Cotton.
COUNTERS, Revolution. See Tachometers.

COUPLINGS, Shaft (Flexible-Insulated)
Ajax Flexible Coupling Co., Westfield, N. Y.
Bartlett Hayward Co., Baltimore, Md.
Bond Co., Charles, 617 Arch, Philadelphia, Pa.
Brown Engineering Co., 123 N. Third, Reading, Pa.
Delbee Rubber Co., Syracuse, N. Y.
Falk Corp., Milwaukee, Wis.
Francke. See Smith & Serrell.
General Electric Co., Schenectady, N. Y.
Grundy. See Bond Co.
Kanti Lever. See Brown Engineering Co.
Krone-Seebek Die Casting & Mfg. Co., 2935 W. 47th, Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Lovejoy Tool Wks., 325 W. Ohio, Chicago, Ill.
Mather. See Bond Co.
Nuttall Wks., of Westinghouse Elec. & Mfg. Co., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Oneida. See Delbee Rubber Co.
Smith & Serrell, 5 Halsey, Newark, N. J.
Webster Mfg. Co., 1856 N. Kostner Ave., Chicago, Ill.
Wood's Sons Co., T. B., Chambersburg, Pa.
COVERING MACHINES, WIRE. See Wire Manufacturing Machines.

CUPS, Grease
Bowen Products Corp., Auburn, New York.
Gits Bros. Mfg. Co., 1960 S. Kilbourn Ave., Chicago, Ill.
Lunkenheimer Co., Cincinnati, Ohio.

CUPS, Oil
Gits Bros. Mfg. Co., 1960 S. Kilbourn Ave., Chicago, Ill.
CUT OUTS, Battery. See Switches, Battery.
CUTTING OUTFITS, Metal. See Welding and Cutting Outfits.
CRANES, Floor. See Lifts, Armature.

CRYSTALS, Chandelier
Crystals, Prisms, Beads, Chains, Fringes.
Crystal Venezia. See Harrison & Co., Arthur.
Friedlaender Co., 49 W. 23rd, New York, N. Y.
Harrison & Co., Arthur, 561 W. Washington Blvd., Chicago.
Hirschberg, Shutz & Co., 268 4th Ave., New York, N. Y. (Fringes.)
Nelson Bead Co., 15 W. 37th, New York, N. Y. (Importer.)
Rialto Import Co., 112 W. 4th, New York, N. Y.
Schwartz Lighting Fixture Wks., 1341 Noble, Philadelphia.
Wyle & Bros., J. J., 20 E. 27th, New York, N. Y.
CURRENT INDICATORS. See Instruments, Pocket.
DASHBOARD METERS. See Instruments, Portable and Switchboard.

DECALCOMANIA
Meyercord Co., 120 S. La Salle, Chicago, Ill.
Novar. See Palm Fechteler & Co.
Palm Fechteler & Co., 67 5th Ave., New York, N. Y.

DIALS
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Enameled. See Dials, Enameled.

DIALS, Enameled
Whittier Co., Horace R., Pequabuck, Conn.
DIAPHRAGM, Cloth. See Cloth, Untreated.
DIE CASTINGS. See Castings, Die.
DIE MAKERS. See Dies, Die Makers.

DIE SETS
Baumbach Mfg. Co., 1810 Kilbourn Ave., Chicago, Ill.
Danly Machine Specialties, Inc., 2104 S. 52nd Ave., Chicago, Ill.
DIES, Pipe. See Stocks, Dies and Reamers.

DIES, DIE MAKERS
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Mareck & Nebel, 255 Greenwich, New York, N. Y.

DISCS, Armature
Steel Discs, Laminations, and Segments for Motors and Transformers.
American Stamping Co., 978 E. 64th, Cleveland, O.
Cleveland Armature Works, 4732 St. Clair Ave., Cleveland.
Hercules Elec. Steel Corp., 145 Lafayette, New York, N. Y.
Lamination Stamping Co., 764 Windsor, Hartford, Conn.
Valley Appliances, Inc., 634 Lexington Ave., Rochester, N. Y.
Willor Mfg. Corp., 117 Mercer, New York, N. Y.
DRAWING MACHINES, WIRE. See Wire Drawing Machines.
DRIVE SCREWS. See Screws, Drive.
DRIVES, CHAIN. See Chain, Power Transmission.

DYNAMOMETERS
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Diehl Mfg. Co., Elizabeth, N. J.
General Electric Co. Schenectady.
EBONITE. See Rubber, Hard.
ELECTROLYTE. See Chemicals, Battery.
ELECTROMAGNETS. See Coils, Finished.

ELECTRODES FOR GAS SIGNS
American Neon Sign Corp., 549 W. 132nd St., New York, N. Y.
Eisler Electric Corp., 756 S. 13th, Newark, N. J.
Manhattan Elecl. Supply Co., 510 Sixth Ave., New York.
Q. R. S. De Vry Corp., 333 N. Michigan Ave., Chicago, Ill.
ELECTRODYNAMOMETERS. See Instruments, Laboratory Standard.
ELEMENTS, Heating. See Units, Rods and Grids.

ENAMELING MACHINES (For Magnet Wire)
(See Also Wire Manufacturing Machines).
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.

ENGRAVING MACHINES
Portable Bench and Pedestal Outfits for Marking Metal.
Brewster Co., Wm., 30 Church, New York, N. Y.
Deckel. See Preis & Co., Inc., H. P.
Eisler Electric Corp., 756 S. 13th, Newark, N. J.
(Tube Base Branders)
Engravograph Corp., 12 Vestry, New York, N. Y.
Etchograph. See Brewster Co., Wm.
Gilbert Supply Co., Independence, Iowa.
Gorton Machine Co., Geo., Racine, Wis.
Preis & Co., Inc., H. P. Newark, N. J.
Schmidt, Inc., Geo. T., 4100 Ravenswood Ave., Chicago, Ill.

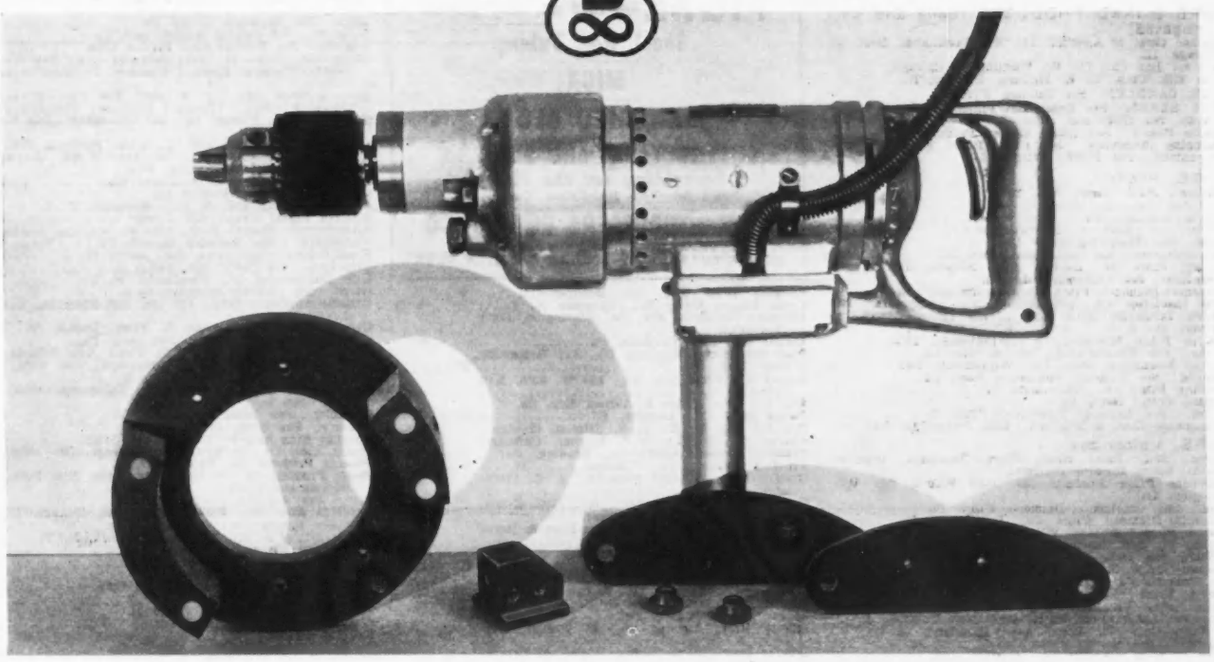
ENGRAVING, Radio Panel
Engraving to Order.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Etch-O-Gravure. See Insuline Corp. of America.
General Fabricating Co., 165 Greenwich, New York, N. Y.
Globe Mfg. Co., 101 Spokane St., Seattle, Wash.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
New England Products Co., 232 Greenwich, New York.
Preis & Co., Inc., H. P., 227 Fulton, New York, N. Y.
Schwenke Machine Engraving Co., 2036 Woodward Ave., Detroit, Mich.
Verichrome Laboratories, 4614 Spring Grove Ave., Cincinnati.
Wright Radio Co., 114 Exchange, Rockland, Mass.

EYELETS
Platt Bros. & Co., Waterbury, Conn.
Waterbury Button & Moulding Co., 835 S. Main, Waterbury, Conn.
Waterbury Button Co., 835 S. Main, Waterbury, Conn.
FABRIC, Radio Grill. See Cloth, Untreated.
FABRIC SHADES. See Shades, Fabric.
FAN BLADES. See Blades, Fan.

FEET, Felt
Brawley, T. R., 279 20th, Brooklyn, N. Y.

FELT
Advance Felt & Cutting Co., 609 W. Lake, Chicago.
American Felt Co., 211 Congress, Boston, Mass.
Booth Felt Co., 460 18th, Brooklyn, N. Y.
Brawley, T. R., 279 20th, Brooklyn, N. Y.
Western Felt Wks., 4029 Ogden Ave., Chicago, Ill.

FERRULES
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, 490 Hancock Ave., Bridgeport, Conn.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Massachusetts Machine Shop, Inc., Boston, Mass.
Patton-MacGuyer Co., Providence, R. I.
Platt Bros. & Co., Waterbury, Conn.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., 99 Mill, Waterbury, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.



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"Advantages of *Bakelite Materials* are many" in manufacture of portable electric tools

SUBJECTED to hard service, outdoors and in, and to frequent abuse in unskilled hands, portable electric tools require rugged insulation. To provide unfailing performance, Clark portables are being insulated throughout with Bakelite Materials.

Bakelite Varnish is used for impregnating the armature coils, which operate at high speed and are subject to rough use and neglect, and it has proven to be most satisfactory.

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Bakelite Engineering Service

Intimate knowledge of thousands of varied applications of Bakelite Materials combined with eighteen years' experience in the development of phenol resinoids for electrical uses provides a valuable background for the cooperation offered by our engineers and research laboratories. Write for Booklets 52L, "Bakelite Laminated" and 52M, "Bakelite Molded."

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y. Chicago Office, 635 West 22nd Street

BAKELITE CORPORATION OF CANADA, LTD. 163 Dufferin Street, Toronto, Ont.

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FERRULES—Continued
Waterbury Button & Moulding Co., Waterbury, Conn.

FIBRE BOARD PRODUCTS (Solid and Corrugated)

Container Corp. of America, 111 W. Washington, Dept. 34, Chicago, Ill.
Mid-West Box Co., 111 W. Washington, Chicago.
Sorton Mfg. Corp., 59 E. Madison, Chicago, Ill.

FIBER CANDLES. See Candles, Fixture.
FIBRE GEARS. See Gears and Pinions, Composition.
Paper. See Cloth and Paper.
Radio Panels. See Radio Molded Parts.
Shipping Containers. See Fibre Board Products.
Vulcanized. See Fibre, Vulcanized.

FIBRE, Phenol

Moisture Proof; Sheet, Rod, Tubes.
Aico. See American Insulator Corp.
American Insulator Corp., New Freedom, Pa.
Amerine. See American Insulator Corp.
Armite. See Spaulding Fibre Co.
Bakelite-Dilecto. See Continental Fibre Co.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Campbellite. See Campbell Fibre Co.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Fibroc Insulation Co., 245 Lincoln Ave., Valparaiso, Ind.
Formica Insulation Co., 4626 Spring Grove Ave., Cincinnati, O.
Franklin Fibre Specialty Co., Wilmington, Del.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Phenolite. See National Vulcanized Fibre Co.
Spaulding Fibre Co., Tonawanda, N. Y.
Synthane Corp., Oaks, Pa.
Vul-Cot. See National Vulcanized Fibre Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

FIBRE, Vulcanized

Sheet, Rod, Tube, Horn, Fibre, Bushings, Washers, Cleats, Screw Machine Products.
Brandywine Fibre Products Co., 1402 Walnut St., Wilmington, Del.
Conite. See Continental-Diamond Fibre Co.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Del.
Diamond F. See Continental-Diamond Fibre Co.
Egyptian. See Delaware Hard Fibre Co.
Electrasate. See Pantasote Co.
Fibre Products Co., New Bedford, Mass.
Franklin Fibre Specialty Co., Wilmington, Del.
Fyberoid. See Wilmington Fibre Specialty Co.
Independent Laboratories, 50 E. 42nd, New York, N. Y.
Iten Fibre Co., 5403 Bower Ave., Cleveland, O.
Leatheroid. See Rogers Fibre Co.
Lincoln Fibre & Specialty Co., Newport, Del.
National Vulcanized Fibre Co., Wilmington, Del.
Ohmoid. See Wilmington Fibre Specialty Co.
Pantasote Co., Inc., 250 Park Ave., New York, N. Y.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass.
Spaulding Fibre Co., Tonawanda, N. Y.
Standard Fibre Products Co., 36 Pleasant, Watertown, Mass.
Vul-Cot. See National Vulcanized Fibre Co.
Vulcawood. See Continental-Diamond Fibre Co.
Wilmington Fibre Specialty Co., Wilmington, Del.

FIBRE WASHERS. See Fibre.
FIELD COILS. See Coils, Finished.

FILAMENTS, Incandescent Lamp

Cohn, Sigmund, 44 Gold, New York, N. Y.
Conneway Elec. Laboratories, 406 Jefferson St., Hoboken.
Filament Supply Co., 1317 Willow Ave., Hoboken, N. J.
Gilby Wire Co., Riverside Ave., Newark, N. J.
National-Harris Wire Co., 195 Verona Ave., Newark, N. J.
Sutter & Nuetzi, 3709½ Lisbon Ave., Milwaukee, Wis.
Vacuum Tube Products, Steneck Trust Bldg., Hoboken, N. J.
Volkmar & Sons, 187 Sylvan Ave., Newark, N. J. (Lead-in-Welds.)

FILES, Commutator Slotting

Ideal Commutator Dresser Co., 1039 Park, Sycamore, Ill.
Martindale Electric Co., 1262 W. Fourth, Cleveland, O.

FISH PAPER. See Cloth and Paper.
FITTINGS, Fixture. See Fixture Fittings.
FIXTURE CANDLES. See Candles, Fixture.
FIXTURE CHAIN. See Chain, Fixture.
FIXTURE, Collars. See Fixture Fittings.

FIXTURE FITTINGS

	KEY
Bowl Holders	See B
Brass Fittings	See B
Canopies	See B
Collars	See B
Crow Feet	See I
Finials (Brass, Glass and Porcelain)	See B
Hangers	See H
Hickies, Brass	See B
Hickies, Iron	See I
Hooks, Brass	See B
Hooks, Iron	See I
Iron Fittings	See I
Loops, Brass	See B
Loops, Iron	See I
Rings	See B
Shade Holders	See S
Shells	See B
Spinnings	See B
Stampings	See B
Stems	See B
Straps	See H
Studs	See I

Acme Lighting Products, Inc., 2114 Woodland Ave., Cleveland, O. Straps ..... H
American Chain Co., Bridgeport, Conn. (Loops and Rings.) ..... B
American Ring Co., Waterbury, Conn. (Candle.) ..... S
Appleton Electric Co., 1703 Wellington Ave., Chicago, Ill. ..... B I
Arco. See American Ring Co.
Arrow Electric Division of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... S
Artoloid. See Great Eastern Brass Wks., Inc.
Art Metal Co., 3721 Dayton, Cleveland, O. ..... H
Banlite. See East Side Metal Spinning Co.
Banner. See Plume & Atwood Mfg. Co.
Barton Brass Wks., 3627 Superior, Detroit .. B
Belmet. See B. & L. Metal Stamping Co.
Bloch Bros., 88 Walker, New York ..... B
Brandt Mfg. Co., 3727 Gratiot Ave., Detroit. B
Braun, J. G., 609 S. Pauline, Chicago, Ill. (Pressed Ornaments.) ..... B I
B. & L. Metal Stamping Co., 250 Moore, Brooklyn, N. Y. (Also Combination Wall Bracket Hanger.) ..... B I .. H
Cambridge Brass Co., Cambridge, Mass. ..... B
Chase Brass & Copper Co., Waterbury, Conn. B .. S
Chatham Metal Spinning & Stamping Corp., 128 Mott, New York, N. Y. ..... B I
Cleanezy. See Dunlap Co.
Colonial Stamping Co., Brill St. & Passaic Ave., Newark, N. J. ..... B .. S ..

FIBRE—*cut to any form*
Sheet, Rod, Tubing
MICA
VARNISHED CLOTH
COTTON TAPES AND SLEEVING
Everything for the Motor
Send for New Insulation Catalogue
THE CONSUMERS RUBBER CO
CLEVELAND 1302-4-6 ONTARIO ST.
CHICAGO 320 WRIGLEY BLDG.

Crescent Brass Mfg. Co., Reading, Pa. ..... B
Crouse-Hinds, Solvay Sta., Syracuse, N. Y. ..... S H
Diamond Needle & Mfg. Co., Torrington, Conn. (Hickies.) I
Dunlap Co., John, Carnegie, Pa. ..... S
East Side Metal Spinning Co., 451 Greenwich, New York, N. Y. ..... B
Eureka Tin Ware Mfg. Co., 135 W. 20th, New York, N. Y. ..... S
E-Z Up. See Plume & Atwood Mfg. Co.
Faries Mfg. Co., Decatur, Ill. ..... B I S H
Flaherty Co., M. E., 28 S. Clinton, Chicago .. I
Fralick Co., S. R., 15 S. Clinton, Chicago .. I
Franklin Brass Foundry Co., Reading, Pa. ..... B
Friedley-Voshardt Co., Chicago ..... B
Grabler Mfg. Co., 6565 Broadway, S. E., Cleveland, O. I
Great Eastern Brass Wks., Inc., 182 Grand, New York, N. Y. (Spindles).
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... S
Incandescent Supply Co., 468 West Broadway, New York, N. Y. ..... B H
Isco. See Incandescent Supply Co.
Jiffy. See White Mfg. Co., J. H.
Kwikon. See Fralick Co., S. R.
Lakin. See Thomas & Betts Co.
Liberty Brass Turning Co., 88 Walker, New York, N. Y. I
Liberty Iron Pipe & Nipple Works, 62 Greene, New York, N. Y. ..... B I
Liberty Machine Co., Wauwatosa, Wis. ..... B I
Light Metal Stamping Co., 310 13th St., West New York, N. J. ..... S
L & K Mfg. Co., 440 Adelphi, Brooklyn, N. Y. ..... H
L. & W. Brass Wks., 361 W. Superior, Chicago, Ill. ..... B
Madelite. See Halann Mfg. Co.
M. S. W. Mfg. Co., 1527 Niagara Ave., Buffalo, N. Y. I
Meta. Products Co., 210 Canal, New York ..... B
Metro Iron Ornament Co., 191 Christie, New York, N. Y. I
Metropolitan-Columbia Mfg. Co., 714 Metropolitan Ave., Brooklyn, N. Y. ..... B
Midwest Elec. Co., 1639 Walnut, Chicago, Ill. .. I
Mid-West Chandelier Co., 14th & Chestnut Sts., Kansas City, Mo. ..... B
Michell-Vance Co., 70 Washington, Brooklyn, N. Y. ..... S
Monarch. See Perfecilite Co.
Murlin Mfg. Co., Philadelphia, Pa. ..... B I
National Electric Products Corp., Pittsburgh, Pa. (Studs.) I
New Era Elec. Mfg. Co., 6725 Machinery Ave., N. E., Cleveland, O. ..... H
New Wrinkle. See Bryant Elec. Co.
New York Brass Turning Co., 568 Broadway, New York, N. Y. ..... B
Nobolt. See Fralick & Co., S. R.
N. W. Cleat Receptacle Bracket, 2437 N. 29th, Philadelphia, Pa. I
Onli. See Perfecilite Co.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. B .. S
Perfecilite Co., 1457 E. 40th, Cleveland ..... S
Pittsburgh Valve & Fittings Co., Barberton, O. .. I
Plume & Atwood Mfg. Co., Waterbury, Conn. B .. S H
Plumwood. See Plume & Atwood Mfg. Co.
Plymouth. See Vester Sons, Alfred.
Products Machine Co., Bridgeport, Conn. ..... B
Reading Brass Co., 141 Schiller, Reading, Pa. B I
Ribaysen Mfg. Co., J., 952 W. Lake, Chicago, Ill. B
Rocale Mfg. Co., 200 Hudson, New York ..... B H
Sandow Tool Co., 1440 Bway, New York, N. Y. .. S
Scovill Mfg. Co., Waterbury, Conn. ..... B I
Simpalite. See Sprecher Mfg. Co., P. W.
Simplex. See Plume & Atwood Mfg. Co.
Springfast. See Plume & Atwood Mfg. Co.
Square-G. See Grabler Mfg. Co.
Standard Snap-Lite Corp., 504 Jackson Ave., Long Island City, N. Y. ..... S
Standard Metal Spinning Co., 128 Mott, New York, N. Y. ..... B
Star. See Perfecilite Co.
Star. See Steel City Elec. Co.
Steel City Elec. Co., Pittsburgh, Pa. I
Steele & Johnson Mfg. Co., Waterbury, Conn. B .. S
Stembridge & Brandt, 29 S. Clinton, Chicago, Ill. (White Metal.) ..... B
Sterling Spinning & Stamping Wks., 476 Broome, New York, N. Y.
T. & B. See Thomas & Betts Co.
Thomas & Betts Co., 63 Vesey, New York I
Uno. See Bryant Elec. Co., also Crouse-Hinds, also General Elec. Co., also Hart & Hegeman Mfg. Co., also Pass & Seymour.
United. See L & K Mfg. Co.
United Metal Spinning Co., 440 Adelphi, Brooklyn, N. Y. ..... B
Vester, Sons, Alfred, 5 Mason, Providence, R. I. B
Victor. See Plume & Atwood Mfg. Co.
Virden, Div. of Gill-Virden Co., 6108 Longfellow Ave., Cleveland, O. ..... B
Walden Tool & Metal Mfg. Co., New Haven Conn.
Wameco. See Waterbury Metal Wares Co.
Waterbury Co., Waterbury, Conn. ..... B
Waterbury Metal Wares Co., Waterbury, Conn. .. S
Weber Brass Co., Whitney Power Block, Cleveland, O. ..... B
White Diamond. See White Mfg. Co., J. H.
White Mfg. Co., J. H., 79 Madison Ave., New York, N. Y. ..... B .. S
Wilhite Machine Wks., 1245 S. Hope, Los Angeles, Cal. ..... B

FLASHERS, Sign

Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.
Ajax. See Reynolds Spring Co.
A. & W. See General Outdoor Adv. Co.
Angelus. See Electric Sign Flasher Corp.
Betts, Inc., James H., 1393 Sedgwick Ave., New York. (Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.)
Betts & Betts Corp., 645 W. 43rd, New York, N. Y. (Motor Flashers.) (Thermal Flashers.) Flashing Plugs.)
California Sign Flasher Co., 280 Guttenberg, San Francisco, Cal.
Commercial Elec. Co., 1203 E. Grant, Portland, Ore.
Cramblet Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Diamond. See General Appliance Corp.
Dominic. See Kala-Flasher Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electric Signal Corp., 406 Fourth Ave., Seattle, Wash.
Electric Sign Flasher Corp., 1826 W. 9th, Los Angeles, Cal.
Figuregram. See Reynolds Electric Co.
Flash O-Lite. See Betts, Inc., James H.
Flip-Flop. See Betts, Inc., James H.
Gem Engineering Co., Hempstead, N. Y.
Gacor. See General Appliance Corp.
General Appliance Corp., 120 8th, San Francisco, Cal. (Flasher Button.)
General Controler Co., 200 E. First, Dayton, O.
Grazier Elec'l Products Co., Johnstown, Pa.
Harrington-Seaberg Corp., 1708 Third Ave., Moline, Ill.
Horni Signal Mfg. Co., 516 Greenwich, New York, N. Y.
Jimbetts. See Betts, Inc., James H.
Kala-Flasher Co., 344 N. Church, Kalamazoo, Mich.
Killark. See Betts & Betts Corp.
Kontroler. See General Controler Co.
Mercuric. See Betts, Inc., James H.
Opalume Sign System, Battle Creek, Mich.
Phelps Elec. Co., 29 S. Clinton, Chicago, Ill. (Motorless)
Phoenix Products Co., Phoenix, N. Y.
Presto Products Co., 64 University Place, New York, N. Y. (Sockets and Plugs.)
Reco. See Reynolds Elec. Co.
Reynolds Elec. Co., 2850 W. Congress, Chicago, Ill.
Reynolds Spring Co., Jackson, Mich.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Ryan. See Phoenix Products Co.
Skedoodle. See Phelps Elec. Co.
Sokit. See Betts, Inc., James H.
Thermo-Wynk. See Betts & Betts Corp.
Vacu. See Betts & Betts Corp.
Veebar. See Betts, Inc., James H.
Way, Eugene W., Seattle, Wash.
Wood Electric Co., C. D., 565 Broadway, New York N. Y.
Woodwin. See Wood Elec. Co., C. D.
Wynk-A-Lyte. See Betts & Betts Corp.

FLASHLIGHT LENSES. See Lenses.
FLEXIBLE ARMS. See Tubing, Flexible Metallic.
FLEXIBLE LEADS, Commutator Brush. See Brushes, Commutator.

FLEXIBLE SHAFT MACHINES

(For shafting. See Tubing, Flexible Metallic.)
Strand & Co., N. A., 5001 N. Lincoln, Chicago, Ill.

FLUTING MACHINES. See Pleating Machines.

FORGINGS, Non-Ferrous

Scovill Mfg. Co., Waterbury, Conn.

FORMS, Coil Winding

Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, O.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Master. See Armature Coil Equipment Co.

FORMS, Wire

Forms and Frames for Shade Holders and Shades: Bending, Welding, Forming.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Arrow Wire Frame Corp., 344 E. 23rd, New York, N. Y.
Blake & Johnson Co., Waterbury, Conn.
Central Wire Frame Co., 154 E. 23rd, New York, N. Y. (Complete with socket, cord and plug.)
Chelsea Wire Wks., 675 Hudson, New York, N. Y.
Clark Metal Products Inc., 490 Hancock Ave., Bridgeport, Conn.
City Wire Frame Co., 2025 S. Michigan Ave., Chicago.
Electro Weld Co., 70 Munroe, Lynn, Mass.
Fischer Spring Co., Chas., 218 Kent Ave., Brooklyn, N. Y.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Jeschke Wire Specialty Wks., Crawfordsville, Ind.
Kreuter's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Manhattan Wire Products Co., 398 First Ave., New York.
Murray Hill Wire Frame Co., 314 E. 32nd, New York, N. Y.
Roebling's Sons Co., John A., Trenton, N. J.
Steinen & Co., 297 Washington, Newark, N. J.
Watral & Sons, 133 E. 16th, New York, N. Y.
Young Industries, Inc., L. A., Detroit, Mich.

FRAMES, Wire. See Forms, Wire.
FRICTION TAPE. See Tape, Rubber and Friction.
FRINGE, Chandelier. See Crystals, Chandelier.

FUSE CLIPS

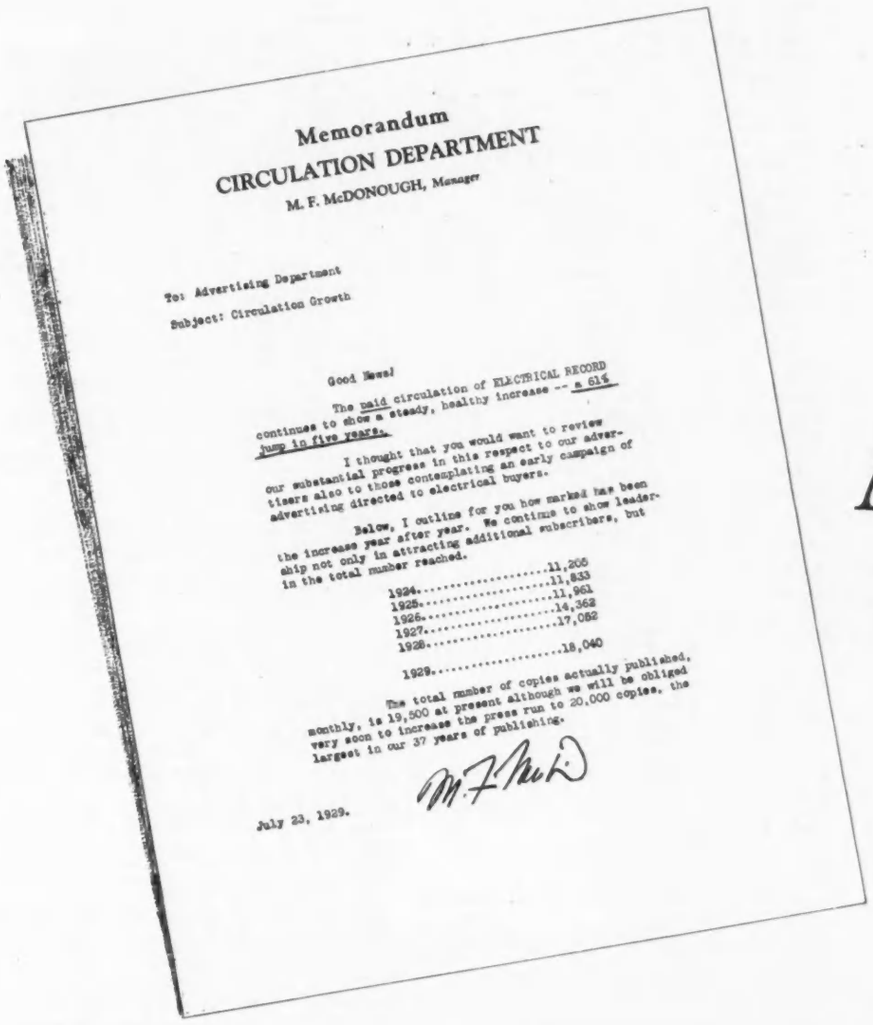
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Waterbury Brass Goods Co., Waterbury, Conn.

FUSE TESTERS. See Testers, Fuse and Circuit.

FUSES AND FUSE WIRE

	KEY
Cartridge	See C
Plug	See P
Non-Refillable	See N
Refillable	See R
Open Link	See O
Fuse Wire	See O

Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. ..... P
Arkless. See Economy Fuse Mfg. Co.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... P N
Automatic Elec. Iron & Fuse Co., 215 S. American, Philadelphia, Pa. ..... P
Buss. See Bussmann Mfg. Co.
Bussmann Mfg. Co., University & Jefferson Ave., St. Louis ..... C P N R O
Chase-Shawmut Co., Newburyport, Mass. .. C P N R O
Clearsite. See Economy Fuse & Mfg. Co.
Clear-Top. See Trico Fuse Mfg. Co.
Colortop. See Trico Fuse Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. (Automobile) ..... C .. N R ..
Cote Bros. Mfg. Co., 182 W. Lake, Chicago C P .. R ..
Crystal. See Royal Elec. Co.
Daum Fuse & Elec. Mfg. Co., 1157 Hedgkiss, Pittsburgh ..... C .. R ..
D. & W. See Graybar Electric Co.
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... C P N R ..
Eco. See Economy Fuse & Mfg. Co.
Electric Fuseguard Co., Charlottesville, Va.. C P N R ..



Memorandum
CIRCULATION DEPARTMENT
M. F. McDONOUGH, Manager

To: Advertising Department

Subject: Circulation Growth

Good News!

The paid circulation of ELECTRICAL RECORD continues to show a steady, healthy increase -- a 61¢ jump in five years.

I thought that you would want to review our substantial progress in this respect to our advertisers also to those contemplating an early campaign of advertising directed to electrical buyers.

Below, I outline for you how marked has been the increase year after year. We continue to show leadership not only in attracting additional subscribers, but in the total number reached.

1924	11,205
1925	11,833
1926	11,961
1927	14,362
1928	17,082
1929	18,040

The total number of copies actually published, monthly, is 19,500 at present although we will be obliged very soon to increase the press run to 20,000 copies, the largest in our 37 years of publishing.

M. F. McD

July 23, 1929.

Electrical Record

Audit
Bureau of
Circulations

Associated
Business
Papers, Inc.

Greater Proof of An Already Proven Medium

THE most exacting test of any advertising medium is its ability to secure interested circulation, and hold it.

Not only has ELECTRICAL RECORD attracted the largest number of buyers as readers but it retains the greatest number as regular subscribers, consistently.

The one plus the other produces an increasing number of readers, annually.

Subscriber mortality is at its lowest ebb with ELECTRICAL RECORD, which loses less and gains more readers, annually, than any other electrical business paper.

Today ELECTRICAL RECORD is the recognized leader in number of subscribers and, more particularly, in the number that it holds. It takes a proven medium to do that—no unknown quantity or quality here.

THE GAGE PUBLISHING COMPANY, INC.
Established 1892
461 Eighth Avenue, New York, N. Y.

Electrical Record *Electrical Manufacturing* *Metropolitan Electrical News* *Gage List of Electrical Buyers*

FUSES AND FUSE WIRE—Continued

Marlott Electric Co., Shreveport, La. . . . . .
Gem. See Chicago-Jefferson Fuse & Electric
General Elec. Co., Merchandise Dept., Bridgeport, Conn. . . . . C P N R . .
Graybar Electric Co., Graybar Bldg., Lexington Ave. and 43rd St., New York, N. Y. C . . . . . .
Great Western Fuse Co., 415 Lexington Ave., New York, N. Y. . . . . C . . . R . .
H. & H. See Hart & Hegeman.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. . . . . P . . R . .
Hudson Wire Co., Ossining, N. Y. . . . . O
Kantark. See Trico Fuse Mfg. Co.
Kirkman Enggr. Co., 1 Dominick St., New York, N. Y. . . . . C P N . . O
Littelfuse Laboratories, 1772 Wilson Ave., Chicago, Ill. (Low Capacity, Glass Enclosed, .025 to 2 Amp.) . . . . . .
Monarch Fuse Co., 116 E. First, Jamestown, N. Y. . . . . C . . N R . .
National. See Economy Fuse & Mfg. Co.
Neark. See Colt's Patent Fire Arms Mfg. Co.
Pierce Renewable Fuses, Inc., 752 Main, Buffalo, N. Y. . . . . C P . . R . .
Platt Bros. & Co., Waterbury, Conn. . . . . O
Powell, F. W., 119 W. Ohio, Pittsburgh. . . P . . R . .
Ree-Nu-It Elec. Co., New Bedford, Mass. . C P . . R . .
Rochester Re-Fill Fuse Co., 402 Cottage, Rochester, N. Y. . . . . C . . . R . .
Royal Elec. Co., Chelsea Station, Boston. . . P N . . .
Shawmut. See Chase-Shawmut Co.
Simplicity. See Cote Bros. Mfg. Co.
Six-in-One. See Industrial Engrg. Co.
Star Fuse Co., 235 Canal, New York, N. Y. C P . . R . .
Trico Fuse Mfg. Co., 1001 McKinley Ave., Milwaukee . . . . . C P N R . .
Union. See Chicago-Jefferson Fuse & Electric

GALVANIZING

Cattle & Bros., Joseph P., Gaul and Lotterly Sts., Philadelphia, Pa.

GALVANOMETERS. See Instruments, Laboratory Standard.

GAS, Inert

Helium Co., Louisville, Ky.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.
Weber, Alfred, 5 Union Square, New York, N. Y.

GAS SIGN ELECTRODES. See Electrodes for Gas Signs

GASKETS, Rubber

Gutta Percha & Rubber Mfg. Co., 15 Park Row, New York.
Canfield Rubber Co., Bridgeport, Conn.

GAUZE BRUSHES, Wire. See Brushes, Commutator.

GEARS, Fibre. See Gears and Pinions, Composition.

GEARS (Speed Changing Units)

Cleveland Worm & Gear Co., Cleveland, Ohio.
Cullman Wheel Co., 1346 Altgild, Chicago, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Falk Corp., Milwaukee, Wis.
Farrell-Birmingham Co., 344 Vielcan, Buffalo, N. Y.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, Ill.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Jones Fdy. & Machine Co., W. A., Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Nuttall Wks., of Westinghouse Elec. & Mfg. Co., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.
Ohio Gear Co., 1333 E. 179th, Cleveland, Ohio.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.
Smith Winfield H., Springville, N. Y.

GEARS, Worm

Albaugh-Dover Mfg. Co., Chicago, Ill.
Cleveland Worm & Gear Co., Cleveland, Ohio.
Colburn Gear & Mfg. Co. (Norfolk Downs), Quincy, Mass.
Ohio Gear Co., 1333 E. 179th, Cleveland, Ohio.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.

GEARS AND PINIONS, Composition

Chicago Stock Gear Wks., 105 S. Jefferson, Chicago, Ill.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Delaware.
Fabroil. See General Elec. Co.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago.
Franklin Fibre Specialty Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Meisel Co., St. Louis, Mo.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Stahl Gear Co., 1390 E. 40th, Cleveland, Ohio.
Stranahan Gear Co., Philadelphia, Pa.
Textoil. See General Electric Co.
Textolite. See General Electric Co.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND PINIONS, Iron and Steel

Earle Gear & Machine Co., Wayne Junction, Philadelphia.
Falk Corp., Milwaukee, Wis.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Meisel Co., St. Louis, Mo.
Meisel Bros. Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Machine & Gear Co., 126 Circuit Ave., Springfield, Mass.
Permag. See Perkins Machine.
Tool Steel Gear & Pinion Co., Cincinnati, Ohio.

GEARS AND PINIONS, Rawhide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Gardes & Co., 50 Church, New York, N. Y.
Syracuse Rawhide Mfg. Co., Syracuse, N. Y.
Western Rawhide & Belting Co., Milwaukee, Wis.

GENERATORS, Electroplating. See Plating Generators.

GLASS BULBS. See Bulbs, Glass.

GLASS CANDLES. See Candles, Fixture.

GLASS LETTERS. See Letters, Sign.

GLASS for Electrical Purposes

Corning Glass Wks., Corning, N. Y.
Pyrex. See Corning Glass Wks.

GLASSWARE

Alba. See Macbeth-Evans Glass Co.
Amazon. See Gleason-Tiebout Glass Co.
Amelites. See Consolidated Lamp & Glass Co.
Apollo. See Gillinder Bros., Inc.
Ardmore. See Jeannette Shade & Novelty Co.
Aurene. See Corning Glass Co.
Aurora. See Consolidated Lamp & Glass Co.
Bayley Sons, 105 Vandervoer, Brooklyn, N. Y.
Beaumont Co., Morgantown, W. Va.

Bellova. See McFaddin & Co., H. G.
Blanco. See Gleason-Tiebout Glass Co.
Beryllite. See Plaut & Co., L.
Bostock, Rhodes & Co., 11 N. Moore, New York, N. Y.
Camia. See Gleason-Tiebout Glass Co.
Carara. See Gleason-Tiebout Glass Co.
Celestialite. See Gleason-Tiebout Glass Co.
Chesler & Sons Co., J., 45 Varick Ave., Brooklyn, N. Y.
Clearcut. See Ivanhoe Division of Miller Co.
Colcite. See Corning Glass Co.
Consolidated Lamp & Glass Co., Coraopolis, Pa.
Cora. See Consolidated Lamp & Glass Co.
Cora-Lites. See Consolidated Lamp & Glass Co.
Corning Glass Co., Corning, N. Y.
Cremax. See Macbeth-Evans Glass Co.
Crystal. See Phoenix Glass Co.
Daylite. See Wells Glass Co.
Delica-White. See Kopp Glass, Inc.
Druid. See Ivanhoe Division of Miller Co.
Eagle Mfg. Co., Wellsburg, W. Va.
Emeralite. See McFaddin, H. G.
Equalite. See Bayley & Sons.
Erskine Glass & Mfg. Co., Wellsburg, W. Va.
Federal Light & Lens Corp., Star City, W. Va.
Florentine. See Gleason-Tiebout Glass Co.
Genco. See Ivanhoe Division of Miller Co.
Gillinder Bros., Inc., Port Jervis, N. Y.
Gillinder & Sons, Inc., Philadelphia, Pa.
Gleason-Tiebout Glass Co., 99 Commercial, Brooklyn, N. Y.
Gletteco. See Gleason-Tiebout Glass Co.
Havana. See Kopp Glass, Inc.
Hocking Glass Co., Lancaster, O.
Holophane Co., 342 Madison Ave., New York, N. Y.
Imperial Glass Co., Bellaire, O.
Inland Glass Works, Chicago, Ill.
Ivanhoe Division of Miller Co., Cleveland, Ohio.
Ivory. See Phoenix Glass Co.
Ivre. See Ivanhoe Division of Miller Co.
Jeannette Shade & Novelty Co., Jeannette, Pa.
Jefferson Glass Co., Follansbee, W. Va.
Kauffeld Glass & Ceramic Co., Star City, W. Va.
Kopp Glass, Inc., Swissvale, Pa.
Lumina. See Hocking Glass Co.
Luminite. See Macbeth-Evans Glass Co.
Macbeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Magnolia. See Phoenix Glass Co.
McFaddin & Co., H. G., 38 Warren, New York, N. Y.
Mellilite. See Gillinder & Sons, Inc.
Micro. See Gillinder & Sons, Inc.
Miller Co., Meriden, Conn.
Monax. See Macbeth-Evans Glass Co.
Moonstone. See Jefferson Glass Co.
N. R. G. See Gillinder & Sons, Inc.
N. U. Glass. See Gillinder & Sons, Inc.
Nebulite. See Gillinder & Sons, Inc.
Nemalite. See Gillinder & Sons, Inc.
Nitro-Glas. See Jefferson Glass Co.
Nuart. See Imperial Glass Co.
Nulite. See Consolidated Lamp & Glass Co.
Nutralux. See Kopp Glass, Inc.
Opalux. See Gleason-Tiebout Glass Co.
Opola. See Inland Glass Co.
Oplex. See Kauffeld Glass & Ceramic Co.
Pastelle. See Consolidated Lamp & Glass Co.
Pearltone. See Inland Glass Co.
Persian. See Gillinder & Sons, Inc.
Phoenix Glass Co., Monaca, Pa.
Pilabrasgo. See Kopp Glass, Inc.
Pittsburgh Cut Glass Co., Monaca, Pa.
Plaut & Co., L., 432 E. 23rd, New York, N. Y.
Poly-Case. See Gleason-Tiebout Glass Co.
Prestepal. See Gleason-Tiebout Glass Co.
Quezal Glass Mfg. Co., Fresh Pond Rd. and Metropolitan Ave., Brooklyn, N. Y.
Radiant. See Phoenix Glass Co.
Regent. See Ivanhoe Division of Miller Co.
Rezelle. See Ivanhoe Division of Miller Co.
Rosedora. See Consolidated Lamp & Glass Co.
Shade-O-Tone. See Consolidated Lamp & Glass Co.
Snow-White. See Inland Glass Works.
Soloman & Son, Inc., L., 199 Wooster, New York, N. Y.
Star Glass Co., Star City, W. Va.
Sudan. See Ivanhoe Division of Miller Co.
Thebian. See Macbeth-Evans Glass Co.
Translux. See Kopp Glass, Inc.
Trojan. See Ivanhoe Div. of Miller Co.
United Novelty Glass Mfg. Co., 121 Prince, New York, N. Y.
Utopia. See Kopp Glass, Inc.
Velaria. See Ivanhoe Division of Miller Co.
Vineland Flint Glass Wks., Vineland, N. J.
Wells Glass Co., Kokomo, Ind.
Williamsburg Flint Glass Co., 290 Broadway, New York
Yural. See Ivanhoe Division of Miller Co.
Zanesville Mould Co., Zanesville, O.

GONGS, Unmounted Shells

Bevin Bros. Mfg. Co., East Hampton, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
East Hampton Bell Co., East Hampton, Conn.
Gong Bell Mfg. Co., East Hampton, Conn.
Hill Brass Co., M. N., East Hampton, Conn.
Liberty Bell Mfg. Co., Minerva, O.
Reiter, G. C., Canton, O.

GRAPHITE BEARINGS. See Bearings, Oil-less.

GRID LEAKS. See Radio Circuit Components.

GRIDS, Resistance. See Units, Rods and Grids.

GRILL CLOTH. See Cloth, Untreated.

GRINDERS, Commutator. See Tools, Commutator Truing.

GROMMETS. See Eyelets.

GROUND LOCATORS. See Instruments, Portable and Switchboard: also Testers, Coil.

GROWLERS, Armature. See Testers, Coil.

HANDLES, Wood; For Switches or Sad Irons

Allen, Chas. E., Pequabuck, Conn.
American Enamel Co., 20 Neville, Providence, R. I.
Bogert & Hopper, 225 Varick, New York, N. Y.
Estes & Son, E. B., 5844 Grand Central Terminal Bldg. New York, N. Y.
Fitchburg Enamel Co., Fitchburg, Mass.
Flanders Hardware Co., North Weare, N. H.
Fuller, J. J. Westfield, Mass.
Narragansett Mach. Co., Pawtucket, R. I.
National Wood Process, New Bedford, Mass.
Novelty Turning Co., Norway, Me.
Ober Mfg. Co., Chagrin Falls, O.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O
Piqua Handle & Mfg. Co., Piqua, Ohio.
Royal Enamel Co., Fitchburg, Mass.
Schutz Bros., 152 Chambers, New York, N. Y.
Stiles & Co., H. A., 174 Portland, Boston, Mass.
Stratton Mfg. Co., Stratton, Maine.
Sun Enamel Wks., Leominster, Mass.

HOLDERS, Brush. See Brushes, Commutator.

HOT WIRE METERS. See Instruments, Portable and Switchboard.

IMPREGNATING COMPOUNDS. See Wax and Compounds

IMPREGNATING, VACUUM. See Ovens, Industrial.

INCANDESCENT LAMP BULBS (Unfinished). See Bulbs, Glass.

INCANDESCENT LAMP FILAMENTS. See Filaments, Incandescent Lamp.

INDICATORS, Operation

Operation and Cost Indicators for Manager's Office.
Bristol Co., Waterbury, Conn. (Elapsed Time Recorder.)
Production Meter Co., 1315 S. Wabash Ave., Chicago, Ill.

INDUCTION COILS. See Coils, Finished.

INSTRUMENT, Jewels. See Jewels.

INSTRUMENTS, Laboratory Standard. See Instruments, Laboratory Standard.

INSTRUMENTS, Portable Testing. See Instruments, Portable and Switchboard: also Instruments, Pocket.

INSTRUMENTS, Laboratory Standard

Beck Bros., 3640 N. Second, Philadelphia, Pa.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Burt, R. C., 327 Michigan Ave., Pasadena, Cal. (Oscilloscopes.)
Cambridge Instrument Co., Grand Central Terminal Bldg., New York, N. Y.
Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago, Ill
Eppley Laboratory, Newport, R. I. (Standard Cells.)
Fahy. See Rubicon Co.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa
Hickok Elec'l Instrument Co., 10514 Dupont, Cleveland, O
Jagabi. See Biddle, James G.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Ranson. See Rawson Elec'l. Instrument Co.
Keivin. See Leeds & Northrup Co.
Kohlrausch. See Leeds & Northrup Co.
Leeds & Northrup Co., 4901 Stanton Ave., Philadelphia, Pa
Milvay. See Chicago Apparatus Co.
Osiso. See Westinghouse Electric & Mfg. Co.
Radio Elec'l Wks., 50 W. 22nd, New York, N. Y.
Rawson Elec'l Instrument Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y
Rubicon Co., 29 N. Sixth, Philadelphia Pa. (Wheatstone Bridges, Galvanometers, Inductance Condensers, Potentiometers, Resistance Boxes, Permeameters.)
Simplex. See Leeds & Northrup Co.
Strobatchy. See Radio Elec'l Wks.
Stromberg Electric Co., 233 W. Erie, Chicago, Ill.
Thompson-Levering Co., 351 N. 57th St., Philadelphia, Pa
Unipivot. See Rawson Elec'l Inst. Co.
Vreeland Apparatus Co., 140 Cedar, New York, N. Y (Sine Wave Oscillators.)
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Freilinghuysen Ave., Newark, N. J.

INSTRUMENTS, Pocket

Advance. See Eldredge Elec'l Corp.
Adbro Mfg. Co., 927 French, Pittsburgh, Pa.
Eclipse. See Eldredge Elec'l Corp.
Eldredge Elec'l Corp., 3 P. O. Sq., Springfield, Mass.
Ideal Instrument Co., Penacook, N. H.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Lundquist Tool & Mfg. Co., Worcester, Mass.
Milavolt. See Adbro Mfg. Co.
Readrite Meter Works, 7 College Ave., Bluffton, Ohio.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Shire Elec. Products Co., Marquette Bldg., Detroit, Mich
Sholder-Excel Mfg. Co., Clyde, Ohio.
Square D Company, Detroit, Mich.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Weston Elecl. Instrument Corp., 582 Freilinghuysen Ave., Newark, N. J.
Wigginton. See Square D Company.
Yankee. See Lundquist Tool Mfg. Co.

INSTRUMENTS, Portable and Switchboard

This heading includes all standard, portable and switchboard types, measuring and testing instruments—ammeters, voltmeters, wattmeters, ohmmeters, cable testers and fault-finders.

See Also Instruments, Pocket; Also Instruments, Laboratory Standard.

Beck Bros., 421 Sedgley Ave., Philadelphia, Pa.
Beeds Instrument Co., Penacook, N. H.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne and Windrim Sts., Philadelphia, Pa.
Cambridge Instrument Co., Grand Central Terminal, New York, N. Y.
Dongan Electric Mfg. Co., 2985 Franklin, Detroit, Mich.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Electric Mfg. Co., 966 Mission, San Francisco, Cal.
Esterline-Angus Co., Speedway, Indianapolis, Ind.
Fidelity Electric Co., Lancaster, Pa.
Fisher Cable Test Sets. See Leeds & Northrup.
Fore Elecl. Mfg. Co., 5233 Wabada Ave., St. Louis, Mo.
Frevn Engrg. Co., 310 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
Ground-Ohmer. See Sticht & Co.
Hamilton-Sangamo Corp., Springfield, Ill.
Handy. See Weinberg & Co.
Hickok Elecl. Inst. Co., 10514 Dupont, Cleveland, O.
Hoyt Elecl. Inst. Wks., 857 Boylston, Boston, Mass.
I T L. See Illinois Testing Laboratories.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Master. See Jewell Elecl. Instrument Co.
M. D. C. See Metropolitan Devices Corp.
Megger Testing Sets. See Biddle.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn
Multi-Volt Trouble Finder. See Welford, Jr., Geo. W.
Nagel Elecl. Co., W. G., 23 St. Clair, Toledo, Ohio.
Norton Elecl. Inst. Co., 81 Hilliard, Manchester, Conn.
Paneltest Meters. See Beede Instrument Co.
Peerless Meters. See Thompson-Levering Co.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Pin-Jack. See Weston Elec'l Instrument Co.
Price Hollister Co., Rockford, Ill.
Quoen. See Gray Instrument Co.
Radio Electric Works, 150 West 22nd St., New York, N. Y.
Rawson Elecl. Inst. Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Shortfinder. See Elsemann Shortfinder Co.
Standee. See Sticht Co., H. H.
States Co., Hartford, Conn.
Sterling Mfg. Co., 2531 Prospect Ave., Cleveland, Ohio.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Tanner Engrg. Co., Rawson St. and Nelson Ave., Long Island City, N. Y.
Test-A-Bat. See Beede Instrument Co.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thomson. See General Electric Co.
Triplex Meters. See Roller-Smith Co.
3 in 1. See Sticht & Co., H. H.
Two-in-One. See Stitcht Co., Herman H.
United States Gauge Co., 44 Beaver, New York, N. Y.
Utility. See Esterline-Angus Co.
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Freilinghuysen Ave., Newark, N. J.

INSULATION (Insulating) (Insulators)

Beads. See Beads, Insulating.
Canopy. See Insulators, Canopy.
Cloth. See Cloth & Paper.

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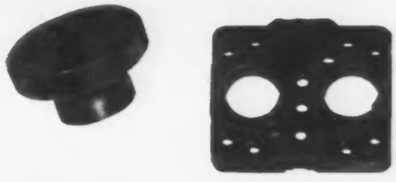

INSULATION (Insulating), Insulators—Continued
Composition. See Molded Insulation.
Compound. See Wax and Comp.
Fibre. See Fibre.
Lava. See Cores, Resistance Coil.
Marble. See Slate.
Mica. See Mica.
Molded. See Molded Insulation.
Paint. See Paint, Varnish, Laquer.
Paper. See Cloth and Paper Insulating.
Phenolic. See Fibre, Phenol. Also Molded Insulation.
Porcelain. See Porcelain.
Rod. See Rubber, Hard.
Rubber. See Rubber, Hard.
Sealing Wax. See Wax and Compounds.
Slate. See Slate.
Soapstone. See Soapstone.
Tubing. See Tubing, Varnished Fabrics.
Varnish. See Paint and Varnish.
Wax. See Wax and Compounds.

INSULATING MACHINES, WIRE. See Wire Manufacturing Machines.

INSULATING TUBING. See Tubing, Varnished Fabric; also Tubing, Rubber.

INSULATION CUTTERS

Artos Engrg. Co., 115 Brown, Milwaukee, Wis.

INSULATION MIXERS

Baker Perkins Co., Saginaw, Mich.

INSULATION SHEARS. See Shears, Insulation.

INSULATION STRAINING MACHINES. See Wire Manufacturing Machines.

INSULATION TESTERS. See Instruments, Laboratory Standard.

INSULATORS, Canopy

Continental-Diamond Fibre Co., Bridgeport, Pa.
Franklin Fibre Specialty Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Knu. See Stanley, Arthur F.
Macallen Co., Boston 27, Mass.
Stanley, Arthur F., 150 Variek, New York, N. Y.
Wilmington Fibre Specialty Co., Wilmington, Del.

IRON CASTINGS. See Castings, Gray Iron.

IRONS, Soldering. See Soldering Irons.

JACKS, Armature. See Lifts, Armature.

JACKS, Radio. See Radio Receiver Parts.

JARS, Battery, Glass

For Composition Jars. See Molded Insulation; also Rubber.
Corning Glass Co., Corning, N. Y.
Cumberland Glass Mfg. Co., Bridgeton, N. J.
Gaynor Glass Works, Salem, N. J.
Gillinder & Sons, Inc., Philadelphia, Pa.
Hazel-Atlas Glass Co., Wheeling, W. Va.
Macbeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Rodefer Glass Co., Bellaire, O.
Sneath Glass Co., Hartford City, Ind.
United States Glass Co., 9th & Bingham, Pittsburgh, Pa.

JEWELS, Instrument Bearing

Bird, Richard H., Waltham, Mass.
Deknatel & Sons, J. A., Queens Village, N. Y.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa
Fisher, Thomas E., Penacook N. H.
Gatti, Inc., Aurele M., Liberty St. & Fairmount Ave., Trenton, N. J.
Moser Jewel Co., Perth Amboy, N. J.
Mildrum Jewel Co., East Berlin, Conn.
Sapphire Products Co., 51 Chambers, New York, N. Y.
Universal. See Oefinger, J. L.
Wennstrom's Sons Co., John, Suffern, N. Y.
Worley Jewel Co., John, Waltham, Mass.

JOINTS, Fixture Insulating

Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill.
Macallen Co., Boston 27, Mass.
Sandow Tool Co., 1440 Broadway, New York, N. Y.
Sprecher Mfg. Co., P. W., 3220 North Ave., Milwaukee.
White Co., O. C., 15 Hermon, Worcester, Mass.
Wittenberg Bros., 60 Shipman, Newark, N. J.

LABORATORY (Laboratories.)

Ovens. See Ovens, Industrial & Laboratory.
Rheostats. See Rheostats.
Testing. See Testing.

LABORATORY STANDARD INSTRUMENTS. See Instruments, Laboratory Standard.

LACQUER, ARMATURE. See Paint, Varnish and Lacquer.

Metal. See Paint, Varnish and Lacquer.

LAMINATIONS. See Discs, Armature.

LAMP BASES. See Bases, Reading Lamp.

LAMP BULBS (Unfinished). See Bulbs, Glass.

LAMP FILAMENTS. See Filaments, Incandescent Lamp.

LAMP LEAD-IN WELDS. See Filaments, Incandescent Lamp.

LAMP TESTING PHOTOMETERS. See Photometers, Lamp Testing.

LATHES

(Special for use in Motor Repairing and Motor Mfg.—Test Bench Lathes).
Ajax Electric Co., Kalamazoo, Michigan.
Allen Electric & Equipment Co., Kalamazoo, Michigan
Cincinnati Lathe & Tool Co., 3207 Disney (Oakley) Cincinnati, Ohio.
Hobart Bros. Company, Troy, Ohio. (Test Bench).
South Bend Lathe Works, 425 E. Madison, South Bend, Ind.
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

LAVA. See Cores, Resistance Coil.

LEAD

American Lead Co., 3112 Penn Ave., Pittsburgh, Pa.
Blatchford Co., E. W., 608 Dearborn, Chicago, Ill.
Columbia Smelting & Refining Wks., 365 West, New York, N. Y.
Eagle-Picher Lead Co., 134 N. LaSalle, Chicago, Ill.
Federated Metals Corp., Woolworth Bldg., New York, N. Y.
Jacobson & Son Co., I. M., 15304 Idaho, Detroit, Mich.

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COOK POTTERY CO.,
Trenton, N.J.

National Lead Co., 111 Broadway, New York, N. Y.
Raymond Lead Co., 735 S. Washtenam Ave., Chicago, Ill.
Turner Lead Co., East St. Louis, Ill.
United Metals Selling Co., 25 Broadway, New York, N. Y.

LEAD-IN WELDS, Lamp. See Filaments, Incandescent Lamp.

LEADS, FLEXIBLE (Commutator Brush). See Brushes, Commutator.

LENSES

Sign Letter, Flashlight, Projector and Reflector Lenses. Also glass caps, jewels and bezels for all electrical devices See also Jewels, Instrument Bearing.
Bausch & Lomb Optical Co., 635 St. Paul, Rochester, N. Y. (Condensing and Projection Lenses.)
B. B. T. Corp. of America, Atlantic Bldg., Philadelphia, Pa.
Corning Glass Wks, Corning, N. Y. (Flashlight and Signal.)
Deknatel & Sons, J. A., Queens Village, N. Y.
Guarz American Optical Co., C. P., 217 E. 34th, New York.
Jefferson Glass Co., Follansbee, W. Va. (Sign and Flashlight.)
Kliegl Bros. Universal Stage Ltg. Co., 321 W. 50th, New York, N. Y. (Condensing and Projector.)
Macbeth Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa. (Flashlight.)
North Light Corp., 30 W. 18th, New York, N. Y.
Popper & Sons, Leo, 147 Franklin, New York, N. Y.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill.
Rochester Glass Products, Inc., 29 N. Water, Rochester, N. Y.
Rodefer Glass Co., Bellaire, O. (Flashlight.)
Sneath Glass Co., Hartford City, Ind. (Sign.)
Stromberg-Carlson Telephone Mfg. Co., 1050 University Ave., Rochester, N. Y.

LETTERS, Sign

Glass, Metal.
Adsign Corp, 113 W. 63rd, New York, N. Y.
Chain Products Co., 3924 Cooper Ave., Cleveland, O. (Brass and White Metal.)
Chicago Miniature Lamp Co., 654 W. Lake, Chicago, Ill. (Raised Letters for Signs.)
Eradium. See Pioneer Corporation.
Federal Elec. Co., 8700 S. State, Chicago, Ill. (Metal.)
Grammes & Sons, Inc., L. F., Allentown, Pa.
Heralite. See Pressed Prism Plate Glass Co.
Kolux Glass Sales Co., Kokomo, Ind.
Lu-Mi-Nus Signs, Inc., 2736 Wentworth Ave., Chicago. (Luminous.)
Manhattan Elecl. Supply Co., 510 Sixth Ave., New York, N. Y. (For Gas Signs.)
Opalite Corp., 201 E. Ohio, Chicago, Ill.
Pioneer Corporation, 8308 Yale Ave., Chicago. (Luminous.)
Pressed Prism Plate Glass Co., Chicago, Ill. (Glass.)

LIFTS, Armature

Lifts, Hoists, Jacks, Trucks, Buggies, Floor Cranes.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Co., Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.

LININGS, Socket

Remington Mfg. Co., 937 Barnum Ave., Bridgeport, Conn.

LOCK WASHERS. See Washers, Lock.

LOOP WINDERS & SPREADERS. See Winding Machines, Armature & Field Coil.

LOUD SPEAKER DIAPHRAGMS MATERIAL. See Cloth, Untreated; also Parchment Paper.

LOUD SPEAKERS

Manufacturers Units and Electric Pick-ups for Portable and Built-in Types.
Amervox. See American Reproducer Co.
American Reproducers Co., 1204 Summit Ave., Jersey City, N. J.
A. R. C. See American Reproducers Co.
Amplion. See Woolf, J. W. & W. L.
Baisa Wood Co., 158 Pioneer, Brooklyn, N. Y.
Baritone Mfg. Co., 846 Jackson Blvd., Chicago, Ill.
Brooklyn Metal Stamping Corp., 720 Atlantic Ave., Brooklyn, N. Y. (Electric Pick-up.)
Cannonball. See Cannon & Miller Co.
Cannon & Miller Co., Springwater, N. Y.
Chelten Electric Co., 4859 Stenton Ave., Philadelphia, Pa.
Conamic. See Operadio Mfg. Co.
Decatur Mfg. Co., 45 Harman St., Brooklyn, N. Y.
Dreher & Son, Chas., 157 Spring, New York, N. Y.
Dymac. See Electrical Products Mfg. Co.
Electrical Products Mfg. Co., Providence, R. I.
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill. (Units.)

Empire United Hat Block Co., 312 E. 12nd, New York.
Engineers Service Co., 25 Church, New York, N. Y. (Kit.)
Ensco. See Engineers Service Co.
Fenco Cone Co., 57 Murray, New York, N. Y. (Kit.)
Fidelity Radio Corp., Salt Lake City, Utah.
F. & H. Radio Laboratories, Fargo, N. D.
Globe Technolian Corp., Reading, Mass.
G. R. P. See Penn Mfg. Co.
Grutal Speaker Co., 609 E. Walnut, Des Moines, Iowa.
Jensen Radio Mfg. Co., 6601 S. Lavanie Ave., Chicago, Ill.
Kersaen Radio Equipment, Inc., 1415 Filiford, Kalamazoo, Mich.
Kyle. See Newcombe-Hawley.
Lata Balsa. See Balsa Wood Co.
Magnavox Co., 4250 Horton, Oakland, Cal. Also Units.
Mandel Electric Co., 2157 N. California Ave., Chicago, Ill.
Markone Radio Mfg. Co., 303 Devoe, Brooklyn, N. Y. (Horn.)
Minuet. See Thompson Radio Co.
Molded Wood Products, 219 W. Chicago Ave., Chicago, Ill.
Newton Elec'l Mfg. Co., Newton, Mass.
O'Neil Mfg. Corp., West New York, N. J.
Operadio Mfg. Co., St. Charles, Ill.
Oxford Radio Corp., 3200 Carroll Ave., Chicago, Ill.
Peerless. See United Reproducers Corp.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa.
Philco. See Philadelphia Storage Battery Co.
Platter Cabinet Co., North Vernon, Ind.
Powerola. See Temple Corp.
Puropower. See Platter Cabinet Co.
Quam Radio Corp., Div. of United Air Cleaner Corp., 9705 Cottage Grove Ave., Chicago, Ill.
Racon Elec. Co., 18 Washington Place, New York, N. Y. (Horn only.)
Red Lion Cabinet Co., Red Lion, Pa.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Swoboda Co., Maritime Bldg., Seattle, Wash.
Temple Corp., 1925 S. Western Ave., Chicago, Ill.
Thompson Radio Co., 25 Church, New York, N. Y.
Ultratone Mfg. Co., 1046 W. Van Buren, Chicago, Ill.
United Reproducers Corp., 25 Leighton Ave., Rochester, N. Y.
Universal. High Power Telephone Co., Carleton Ave. and Eddy, Seattle, Wash.
Utah Radio Products Co., 1615 S. Michigan Ave., Chicago, Ill. (Also Piano Unit.)
Victor Radio Corp., 4321 N. Western Ave., Chicago, Ill.
Wondrphone. See Universal High-Power Telephone Co.
Woolf, J. W. & W. L., 133 W. 21st, New York, N. Y.
Wright-De Coster, Inc., St. Paul, Minn.

LUGS, Copper

Anderson Mfg. Co., Albert & J. M., 289 A St., Boston, Mass.
Dante Elecl. Mfg. Co., Bantam, Conn.
French Mfg. Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich.

LUMINOUS SPECIALTIES

KEY
Luminous Compound .....See C
Pendants (Bulbs) .....See P
Standard Parts .....See S

Acornlite Studios, 675 72nd, Brooklyn, N. Y..... P
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn..... S P
Bryant Electric Co., Bridgeport, Conn..... P
Connecticut Elec. Mfg. Co., Bridgeport, Conn..... S
Cutler-Hammer, Inc., 1238 St. Paul Ave., Milwaukee, Wis.
Eagelite. See Eagle Elec. Mfg. Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y..... P
General Elec. Co., Merchandise Dept., Bridgeport, Conn..... S P ..
Glow Lite. See Rodale Mfg. Co.
Glow Tip. See Arrow Electric Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Electric Co., Hartford, Conn..... S P
Hubbell, Inc., Harvey, Bridgeport, Conn..... P
Luma & Luma Lite. See Radium Dial Co.
Radieye. See General Electric Co.
Radium Dial Co., 3532 Forbes, Pittsburgh, Pa.... C .. P
Reynolds Spring Co., Jackson, Mich..... S ..
Rodale Mfg. Co., 200 Hudson, New York, N. Y..... P
Seelite. See T. C. Smith & Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia .. P
Spot O Life. See Hart & Hegeman Mfg. Co.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y..... C S P

MACHINE SCREWS. See Screws, Machine.

MACHINE SCREW PRODUCTS. See Screw Machine Products.

MACHINES

Armature Banding. See Banding Machines, Armature.
Armature Notching. See Notching Machines, Armature.
Balancing. See Balancers, Armature.
Banding. See Banding Machines, Armature.
Cable Armoring. See Wire Manufacturing Machines.
Coil Shaping. See Shaping Machines, Coil.
Coil Taping. See Taping Machines, Coil.
Coil Winding. See Winding Machines.
Commutator Slotting. See Mica Undercutters.
Engraving. See Engraving Machines.
Incandescent Lamp Making. See Machines, Lamp Making.
Molded Insulation. See Presses, Molded Insulation.
Perforating. See Perforating Machines.
Porcelain Molding. See Presses, Porcelain Molding.
Radio Tube. See Machines, Lamp Making.
Shaping. See Shaping Machines, Coil.
Slotting. See Mica Undercutters.
Soldering. See Soldering Machines, Commutater.
Spring Making. See Spring Making Machines.
Taping. See Taping Machines, Coil.
Tension. See Tension Machines, Band Wire.

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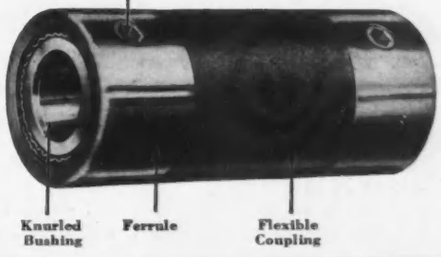

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Wire Measuring. See Wire Manufacturing Machines.
Wire Tension. See Tension Machines, Band Wire.
Wire Wrapping. See Wire Wrapping Machines.

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MACHINES, Pleating and Fluting. See Pleating Machines.
MACHINES, Spring Making. See Spring Making Machines
MACHINES, WIRE MANUFACTURING. See Wire Manufacturing Machines.
MAGNET CHARGERS. See Chargers, Magnet.
MAGNET STEEL. See Steel, Magnet.
MAGNET TESTERS. See Instruments, Portable and Switchboard; also Instruments, Pocket.
MAGNET WIRE MACHINES. See Enameling Machines for Magnet Wire.
MAGNETIC CHUCKS. See Chucks, Magnetic.
MAGNETIC CLUTCHES. See Clutches, Magnetic.
MAGNETOMETERS. See Instruments, Pocket.

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Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
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Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Crude Pelt. See Chicago Rawhide Mfg. Co.
Holbrook Raw Hide Mfg. Co., 748 N. Main, Providence, R. I.

MANGANESE, Battery. See Chemicals, Battery.
MEASURING INSTRUMENTS. See Instruments.
METAL CUTTING OUTFITS. See Welding and Cutting
MECHANICAL RUBBER GOODS. See Rubber Mechanical Goods.
MEGOHMMETERS. See Instruments, Laboratory Standard
MERCURY SWITCHES. See Switches, Mercury.
METAL CLEANERS (Compound). See Cleaners, Metal.
Outfits.
METAL FINISHING. See Plating & Finishing.
METAL MARKING OUTFITS. See Engraving Machines
METALLIC SHADES. See Shades, Metallic.
METERS. See Instruments.
MICA SHADES. See Shades, Mica.
MICA TAPE. See Tape, Mica.
MICA UNDERCUTTERS. See Slotting Machines & Tools, Commutator.

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Asheville Mica Co., Biltmore, N. C.
Asco. See Schoonmaker Insulation Co.
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Chicago Mica Co., 345 Campbell, Valparaiso, Ind.
Colonial Mica Co., 136 Seventh, Jersey City, N. J.
Fillion, S. O., 68 Murray, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Gerdau Co., Otto, 533 Canal, New York, N. Y.
Hirsch Mica Co 1087 Flushing Ave., Brooklyn, N. Y.
Hoyt, Inc., Philip S., Los Tablos, New Mexico.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
International Mica Co., 3660 Brandywine, Philadelphia, Pa
Kant Krack. See Huse Liberty Mica Co.
Keene Mica Co., Keene, N. H.
Macallen Co., Boston 27, Mass.
Micabond. See Chicago Mica Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Miralite. See Mitchell-Rand Mfg. Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Micanite See Mica Insulator Co.
Mica Products Mfg. Co., 54 Greene, New York, N. Y.
Munsell & Co., Eugene, 200 Varick, New York, N. Y.
Nemco. See New England Mica Co.
New England Mica Co., Waltham, Mass.
New England Minerals, Inc., 85 Devonshire, Boston, Mass.
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MIXERS, INSULATION. See Insulation Mixers
MOLDED
Presses. See Presses, Molded Insulation.
Radio Parts. See Radio Molded Parts.
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Ambleroid. See Ambler Asbestos Shingle & Sheathing Co.
American Insulator Corp., New Freedom, Pa.
American Machine & Foundry Co., 5520 Second Ave., Brooklyn, N. Y.
Amerine. See American Insulator Corp.
Anderson Mfg. Co., Albert & J. M., 289 A. Boston, Mass.
Auburn Button Wks., 48 Canoga, Auburn, N. Y.
Bakelite Corp., 247 Park Ave., New York, N. Y.
Bay State Moulding Co., 1197 Dorchester Ave., Boston.
Belden Mfg. Co., 2210B S. Western Ave., Chicago, Ill.
Beldenmeld. See Belden Mfg. Co.
Bell Mfg. Co., 11 Elkins, Boston, Mass. Radio Parts
Boonton Molding Co., Boonton, N. J.
Boonton Rubber Mfg. Co., 223 Fanny Rd., Boonton, N. J.
Brownlite Moulding Corp., 109 Hudson, Jersey City, N. J (Wood Composition.)
Celluloid Corp., 10 E. 40th, New York, N. Y.
Cetelite. See Connecticut Molded Products Corp.
Cetec. See Connecticut Molded Products Corp.
Cepco. See Connecticut Molded Products Corp.
Coltrock. See Colt's Patent Firearms Mfg. Co.
Charmond Elec. Corp., 30 Church, New York, N. Y.
Chicago Molded Products Co., 2149 Walnut, Chicago, Ill.
Cincinnati Molding Co., 2037 Florence Ave., Cincinnati, O.
Colasta Co., Hoosick Falls, N. Y.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Compo-Site, Inc., 207 Astor, Newark, N. J.
Condensite. See Bakelite Corp.
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Connecticut Molded Products Corp., Meriden, Conn. (Cold.)
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Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
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Diemoulding Production Co., Canastota, N. Y.
Dimco. See Dayton Insulating Moulding Co.
Durez. See General Plastics, Inc.
Electrose. See Insulation Mfg. Co.
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Evercool. See Bakelite Corp.
Formica Insulation Co., 4626 Spring Grove Ave., Cincin-
Garfield Mfg. Co., Garfield, N. J. Composition. (Cold.)
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Gummor. See Garfield Mfg. Co.
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Herculite. See Colosta Co.
Hi-Heat. See Insulation Mfg. Co.
Imperial Molded Products Co., 2925 W. Harrison, Chicago
Improco. See Insulation Products Co.
Inda. See American Machine & Foundry Co.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Insulation Products Co., Richland, Pittsburgh, Pa.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y
International Insulating Corp., Elyria, O.
Karolith Corp., 189 13th, Long Island City, N. Y. (Casein plastics.)
Kellite. See Kellogg Switchboard & Supply Co.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Klagges, Chas., 128 147th, Ozone Park, N. Y.
Kuhn & Jacob Machine & Tool Co., 502 Prospect Ave Trenton, N. J.
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Lacanite. See Scranton Button Co.
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Micarta. See Westinghouse Elec. & Mfg. Co.
Mico. See Molded Insulation Co.
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Molded Insulation Co., Mt. Vernon, N. Y.
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Nixonoid. See Nixon Nitration Works.
Noark. See Colt's Patent Fire Arms Mfg. Co.
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Norton Laboratories, Inc., 1025 Mill, Lockport, N. Y.
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Paramix. See Reliance Radio Corp.
Paratherm. See Scranton Button Co.
Phenolic. See Scranton Button Co.
Plastic Molding Corp., Sandy Hook, Conn. (Cold.)
Pollopas. See Wilbur & Williams.
Pruven Composition Products Corp., Milford, Conn.
Pruvenite. See Pruven Composition Products Co.
Pyrolax. See Cutler-Hammer Mfg. Co.
Recto Mfg. Co., 23 W. 3rd, Cincinnati, O.
Redmond. See Bakelite Corp.
Rexlite. See Northern Industrial Chemical Co.
Reynolds Spring Co., Jackson, Mich.
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Richardson Co., Lockland, Cincinnati, O
Ridgelite See Ridgley Trimmer Co.
Ridgley Trimmer Co., Springfield, O.
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Armor Elec. Mfg. Co., 1020 Holland, Erie, Pa.	M	..	..	..
Baldor Elec. Co., 4352 Duncan Ave., St. Louis	M	F	S	..
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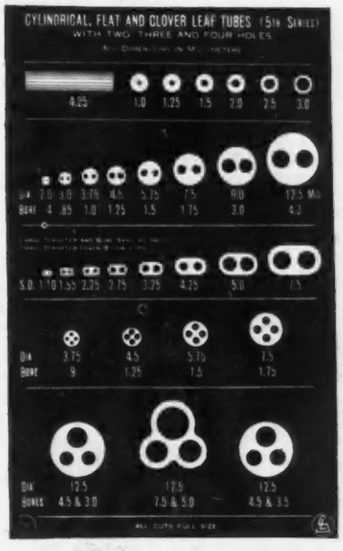

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Cushman Elec. Co., Concord N. H..... M F S ..
Day-Fan Electric Co., Dept. A, Dayton, O.... .. F S ..
Diehl Mfg. Co., Elizabeth, N. J..... M F S ..
Diverter Pole. See Rochester Elec. Product Co.
Domestic Electric Co., 7200 St. Clair Ave., Cleveland, O. .... S U
Dumore Co., 35 16th, Racine, Wis..... .. F .. U
Eclipse. See Fidelity Elec. Co.
Electric Machinery Co., Minneapolis, Minn.. M .. S ..
Electric Products Co., 1735 Clarkstone Rd., Cleveland, O. .....
Electric Specialty Co., 231 South Stamford, Conn. M F S U
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Emerson Electric Mfg. Co., 2018 Washington Ave., St. Louis, Mo..... M F S U
Engberg's Elec. & Mechl. Works, St. Joseph, Mich. ..... M .. S ..
Esco. See Electric Specialty Co.
Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago, Ill. ..... M F .. ..
Fidelity Elec. Co., Lancaster, Pa..... M F S U
Fitzgerald Mfg. Co., Torrington, Conn..... .. F .. ..
Fynn Welchsel. See Wagner Elec. Corp.
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Janette Mfg. Co., 551 W. Monroe, Chicago..... .. F S ..
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Kimble Elec. Co., 634 N. Western Ave., Chicago M .. S U
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Leland Elec. Co., Dayton, O..... .. F S ..
L. E. See Leland Elec. Co.
Lincoln Elec. Co., Cleveland, Ohio..... M .. S ..
Line-Weld. See Lincoln Elec. Co.
Linzee Elec. Motor Co., Mansfield, O..... M .. .. ..
Mando Co., 911 State Tower Bldg., Syracuse, N. Y. (6-12-40 Volt only)..... F .. .. ..
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Marble-Card Elec. Co., Gladstone, Mich..... M .. .. ..
Master Electric Co., Dayton, O..... M F S ..
MC. See General Electric Co.
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N. C. See Electric Controller & Mfg. Co.
Norfolk. See Walter Elec. Mfg. Co.
North East Elec. Co., Rochester, N. Y..... F .. U
Northwestern Mfg. Co., 480 Clinton, Milwaukee M .. .. ..
Ohio Elec. & Controller Co., 5903 Maurice Ave., Cleveland, Ohio .... F S ..
O. K. See Marathon Elec. Mfg. Co.
Osann Co., F., 245 Seventh Ave., New York M .. .. ..
Peerless Elec. Co., 740 W. Market St., Warren, O. M F S U
Polar Cub. See Gilbert Co., A. C.
Pow-R-Full. See Wagner Elec. Corp.
Reco. See Reynolds Electric Co.
Red Band. See Howell Elec. Motors Co.
Reliance Elec. & Engrg. Co., 1942 Ivanhoe Rd., Cleveland, O. ..... M .. S ..
Reynolds Electric Co., 2650 W. Congress, Chicago .. F S ..
Robbins & Myers, Inc., Springfield, O..... M F S U
Standard. See Robbins & Myers Co.
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Sturtevant Co., 15 Devonshire (Hyde Park), Boston, Mass. ..... M F S U
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Super Wick. See Master Elec. Co.
Switch start. See Lincoln Elec. Co.
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U. S. Elec. Mfg. Co., 200 E. Slauson Ave., Los Angeles ..... M .. S ..
Valley Elec. Co., 4321 Forest Park Blvd., St. Louis, Mo. ..... M .. S ..
Wagner Elec. Corp., 6400 Plymouth Ave., St. Louis, Mo. ..... M F S U
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Welco Uniframe. See Wesche Elec. Co., B. A.
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Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Electro-Chemical Engraving Co., 52 Vanderbilt Ave., New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y.
Etching Co. of America, 1520 Montana, Chicago, Ill.
General Etching & Mfg. Co., 3070 W. Grand Ave., Chicago Ill.
Grammes & Sons Inc., L. F., Allentown, Pa.
Meyercord Co., 1147 State Bank Bldg., Chicago, Ill.
Premier Metal Etching Co., 14th & Van Alst Ave., Long Island City, N. J.
Turner Brass Works, Sycamore, Ill.
Waterbury Button & Moulding Co., Waterbury, Conn.

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American Mond Nickel Co., Century Bldg., Pittsburgh, Pa.
Driver-Harris Co., Harrison, N. J.
International Nickel Co., 67 Wall, New York, N. Y.
National-Harris Wire Co., 195 Verona Ave., Newark, N. J.
Seymour Mfg. Co., Seymour, Conn.
United States Nickel Co., New Brunswick, N. J.

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Ferracute Machine Co., Bridgeton, N. J.

NUT SETTING MACHINES

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OIL-LESS BEARINGS. See Bearings, Oil-less.

OSCILLOSCOPES. See Instruments, Laboratory Standard.

OVENS, Industrial and Laboratory
Annealing, Temper Drawing, Mold Baking, Vulcanizing, Drying, Conditioning, Enameling, Japanning, Vacuum Impregnating.

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Conran, Frederick M., 107 Colden, Newark, N. J.
Crawford Oven Co., New Haven, Conn. (Coil Driers.)
Despatch Oven Co., 622 Ninth, S. E., Minneapolis, Minn.
Detroit Sheet Metal Wks., 1341 E. Milwaukee Ave., Detroit, Mich.
Devine Mfg. Co., J. P., Buffalo, N. Y.
Eberbach & Son Co., Ann Arbor, Mich. (Drying.)
Electric Heat Control Apparatus Co., 245 New Jersey R. R Ave., Newark, N. J.
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Frank Thermo Elec. Co., 1206 Grove, Irvington, N. J.
Gehnrich Indirect Heat Oven Co., Long Island City, N. Y
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Heidbrink Co., 2633 Fourth Ave., S., Minneapolis, Minn
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Kenworthy, Chas. F., 196 Piedmont, Waterbury, Conn.
Maehler Co., Paul, 2210 Lake, Chicago, Ill.
Miho Co., 717 Sycamore, Cincinnati, O.
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Sargent & Co., E. H., 155 E. Superior, Chicago, Ill.
Sioux Battery & Mfg. Co., Sioux City, Ia. (Battery.)
Snead & Co., Jersey City, N. J.
Standard Elec. Stove Co., Toledo, Ohio.
Steiner & Co., R. E., 197 E. Kinney St., Newark, N. J
Stokes Machine Co., F. J., 5834 Tabor Rd. (Olney), Philadelphia.
Swarthout Co., 18522 Euclid Ave., Cleveland, O.
Thelco. See Freas Thermo Elec. Co.
Westinghouse Elec. & Mfg. Co., Mansfield, O
Young Bros. Co., 6523 Mack Ave., Detroit, Mich.

OXIDES, Battery. See Chemicals, Battery.

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Federal Metallic Packing Co., Wakefield, Mass
Holed-Tite Packing, Inc., 100 E. 42nd, New York, N. Y.
Packtite. See Federal Metallic Packing Co.

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Varnishes, Insulating .....See V
Painting, Dipping, Spraying, Vacuum Impregnating.
Paint, Insulating and Acid Proof..See P
Lacquer, Metal Finishing .....See L

Acme White Lead & Color Wks., 8250 St. Aubin Ave., Detroit, Mich. L
Ajax. See Sherwin-Williams Co.
Alaka. See Lacquer & Chemical Corp.
American Di-Electrics, Ltd., Hancock and Bodine, Long Island City, N. Y. ..... V .. L
Amerimn Lastite Co., 3166 Lincoln Ave., Chicago... P L
American Wurtzilite Co., Builders Bldg., Chicago .. P ..
Antakwa Co., 1329 Mohawk, Chicago, Ill. ..... P ..
Arizona Lacquer Mfg. Co., 7 16th, Brooklyn, N. Y. L
Armlac. See Robertson Chemical Co.
Arslac. See Arizona Lacquer Mfg. Co.
Art-Craft. See Southwestern Paint & Varnish Co.
Atlantic Chemical Co., Colt, Irvington, N. J..... L
Atom Chemical Co., 96 E. 10th, New York, N. Y..... L
Bakelite Corp., 247 Park Ave., New York, N. Y..... L
Benolite Varnish Co., 501 Columbia Bank Bldg., Pittsburgh ..... V P ..
Berry Bros., Leib & Wight, Detroit, Mich..... V .. ..
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Code 25. See Mitchell-Rand Mfg. Co.
Columbus Varnish Co., 264 Cozzens, Columbus, O. V .. ..
Comulac. See Martindale Elec. Co.
Continental-Diamond Fibre Co., Bridgeport, Pa. V .. ..
Day & Co., James B., 1872 Clybourn Ave. Chicago, Ill. ..... P L
Doe & Co., Walter S., Kent, Ohio..... .. P ..
Dolph Co., John C., 168 Emmet, Newark, N. J.. V P ..
Duco. See Du Pont de Nemours & Co.
Du Pont de Nemours & Co., Wilmington, Del.... P ..
Dures. See General Plastics.
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Electric Lacquer. See Dolph Co., John C.
Enamelac. See Robertson Chemical Co.
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Fesco. See Ferbert-Schorndorfer Co.
Five Point. See American Wurtzilite Co.
Franche & Co., 440 Orleans, Chicago, Ill..... .. L
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General Electric Co., Schenectady, N. Y..... .. P
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George Co., P. D., 4153 Bingham Ave., St. Louis, Mo. ..... V .. ..
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Insulvar. See Varflex Corp.
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Kodalak. See Eastman Kodak Co.
Krakles. See Waukegan Chemical Co.
Lacquer & Chemical Corp., 214-40th St., Brooklyn, N. Y. ..... P L
Laqueroid. See Glidden Co.
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M. I. C. See Mica Insulator Co.
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Meters. See Instruments, Portable & Switchboard

PAPER
Boxes. See Boxes & Wrappers.
Bushings. See Tubes, Paper.
Candles. See Candles, Fixture.
Cores. See Tubes, Paper.
Fibre. See Cloth and Paper.
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Parchment. See Parchment Paper.
Shades. See Shades, Fabric.
Sleeves. See Tubes, Paper.

PARAFFINE. See Wax and Compounds.

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Kino-Lamp. See Raytheon Mfg. Co.
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Wire Gauze. See Brushes, Commutator.
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PINIONS. See Gears and Pinions.

PINION PULLERS. See Pullers, Armature Shaft.

PLASTICS. See Molded Insulation.

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PLUG RECEPTACLES. See Receptacles, Plug.

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Real Diamond. See Smith & Co., T. C.
Reben Electric Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Reneo. See Reben Elec. Mfg. Co.
Reynolds Spring Co., Jackson, Mich.
Reynolite Masterpiece. See Reynolds Spring Co.
Ripple. See Bryant Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York.
Safegard Elec. Appliance Co., 133 S. Twelfth, Philadelphia.
Samson Cutlery Co., 8 Jones, Rochester, N. Y.
Sears, Henry D., 30 Boylston, Boston 11, Mass.
Smith & Co., T. C., 2015 Powelton Ave., Philadelphia, Pa.
Snapit. See Marks Products Co.
Snoco. See Snow & Co., E. W.
Snow & Co., E. W., Rochester, N. Y.
Spartanette. See Bryant Elec. Co.
Spar Tap. See Bryant Elec. Co.
Speedway Elec. Mfg. Co., 30 Church, New York, N. Y.
Standard. See Cutler-Hammer Mfg. Co.
Suitzall. See Beaver Mfg. Co.
Surefit. See Alcor Mfg. Co.
T. E. C. See Electric Co.
Tedeo. See Paragon Elec. Sales Co.
Telltale Tap. See General Elec. Co.
Templus. See Bryant Elec. Co.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trio-Tap. See Rodale Mfg. Co.
Triple Tap. See General Elec. Co.
Twin Tap. See General Elec. Co.
United States Elec. Mfg. Co., 222 W. 14th, New York.
Un-X-Ld. See Speedway Elec'l Mfg. Co.
Utilo Mfg. Co., 320 E. Liberty, Lancaster, Pa.
Weber. See Sears, Henry D.
Wellmade Elec. Mfg. Co., Torrington, Conn.
Wilshires. See Iona Co.
Yankee. See Beaver Mfg. Co.

POCKET METERS. See Instruments, Pocket.

POINTS, Contact
American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J. (Gold, Platinum, Silver.)
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J. (Platinum and Silver.)
Cohn, Sigmund, 44 Gold, New York, N. Y. (Platinum.)
Elkon, Inc. (Div. of P. R. Mallory Co.), 350 Madison Ave., New York, N. Y.
Fansteel Products Co., North Chicago, Ill.
Hardy Metal Corp., Seattle, Wash.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Independent Contact Mfg. Co., 545 39th, Union City, N. J. (Tungsten.)
Interstate Products Corp., 29 Commercial, Newark, N. J. (Platinum and Silver.)
National Contact Co., 33 W. 60th, New York. (Platinum.)
Niehoff & Co., C. E., 230 W. Superior, Chicago. (Platinum.)
Spark-O-Metal. See Hardy Metal Corp.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., Newark, N. J. (Platinum and Silver.)

POLARITY INDICATORS. See Instruments, Pocket.

POLISHING MACHINES, WIRE. See Wire Polishing Machines.

PORCELAIN
Bushings. See Bushings, Bus & Cabinet.
Liquid. See Cement, Liquid Porcelain.
Molding Machine. See Presses, Porcelain Molding.
Reflectors (Enameled). See Reflectors, Porcelain Enameled.
Refractory. See Cores, Resistance Coil.

PORCELAIN, Special Shapes
Akron Porcelain Co., Akron, Ohio.
American Porcelain Co., E. Liverpool, O.

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A. P. See Akron Porcelain Co.
Burgess & Co., East Liverpool, O.
Central Porcelain Co., Columbiana, O.
Circle F Mfg. Co., Trenton, N. J.
Colonial Insulator Co., Akron, O.
Connecticut Porcelain Co., Trenton, N. J.
Cook Pottery Co., Trenton, N. J.
Corns China Co., Wellsville, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Globe Porcelain Co., Mulberry St. and St. Joes Ave., Trenton, N. J.
Hartford Faience Co., Hartford, Conn.
Hub-Way Mfg. Co., Hubbard, Ohio.
Illinois Electric Porcelain Co., Macomb, Ill.
Imperial Porcelain Wks., Canal and Mulberry, Trenton N. J.
Knox Porcelain Corp., Knoxville, Tenn.
Louthan Mfg. Co., East Liverpool, O.
Mercer Porcelain Co., Trenton, N. J.
Metach Refractories Co., East Liverpool, Ohio.
National Porcelain Co., Trenton, N. J.
New Jersey Porcelain Co., Trenton, N. J.
Nu Blac. See Star Porcelain Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Porcelava. See Burgess & Co.
Porcelain Products, Inc., Findlay, Ohio.
Square D Company, Detroit, Mich.
Standard & Specialty Porcelain Co., Sun Prairie, Wis
Star Porcelain Co., Mulrhead St., Trenton, N. J
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.
Thomas & Sons Co., R., Lisbon, O.
Trenle Porcelain Co., East Liverpool, Ohio.
Union Elec'l Porcelain Wks., Inc., Trenton, N. J.
Washington Porcelain Co., Washington, N. J.

POROUS CUPS
Unglazed earthenware cups for primary (wet) batteries
Colonial Insulator Co., Akron, Ohio.
Maddocks Sons, John, Trenton, N. J.
Ohio Pottery Co., Zanesville, Ohio.
Robinson Clay Products Co., Akron, Ohio.

POSTS, Binding
Binding Posts, Switch Parts, Stop Points, Contacts Arms, Levers. See also Radio Mountings.
American Radio Hardware Co., 135 Grand, New York
Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
DeJur-Amsco Corp., 418 Broome, New York, N. Y.
Eby Mfg. Co., Inc., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Ensign. See Eby Mfg. Co., H. H.
Eureka. See Frank W. Morse Co.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros., Plano, Ill.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
King. See Morse Co., Frank W.
Morse Co., Frank W., 280 Congress, Boston. (Spring Grip
Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Polk, J. L., 41 Bell Ave., Troy, N. Y.
Premier Elec. Co., 1802 Grace, Chicago, Ill.
Quality. See H. H. Eby Mfg. Co.
Queen. See Morse Co., Frank W.
Thomaston Mfg. Co., Thomaston, Conn
Waterbury Button & Moulding Co., Waterbury, Conn.

POTENTIOMETERS (Instruments). See Instruments, Laboratory Standard.

POTENTIOMETERS (Radio Control). See Radio Receiver Parts.

POWDERED CARBON. See Carbon, Powdered.

POWER TRANSMISSION CHAIN. See Chain, Power Transmission.

PRESS BOARD. See Cloth and Paper.

PRESSES, Armature Coil
Comstock Mfg. Co., Wilkes-Barre, Pa.

PRESSES, ARMATURE NOTCHING. See Notching Machines, Armature.

PRESSES, Molded Insulation
Burroughs Co., 246 N. Tenth, Newark, N. J.
Dunning & Boschert Press Co., 329 W. Water, Syracuse
Elmes Engrg. Works, Chas. F., 230 N. Morgan, Chicago
Evans Engrg. Works, Chas. E., 1002 Fulton, Chicago, Ill
Farquhar Co., A. B. York, Pa.
French Oil Mill Machinery Co., Piqua, O.
Southwark Fdy. & Mach. Co., 400 Washington Ave., Philadelphia, Pa.
Stokes Mach. Co., F. J., 5834 Tabor Rd. (Olney), Philadelphia, Pa.
Terkelson Machine Co., 326 A, Boston, Mass.
Watson-Stillman Co., 75 West St., New York, N. Y
Wood & Co., R. D., Florence, N. J.

PRESSES, Porcelain Molding
Baird, Andrew, 2715 Newark, Detroit, Mich.

PRESSES, Punching
Bench Presses—Power Presses; for Punching & Stamping Sheet Metal.
Ams Machine Co., Max, 101 Park Ave., New York, N. Y
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., 53rd St. & Second Ave., Brooklyn, N. Y
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hyro Mfg. Co., 200 Varick, New York, N. Y
Loughbough-Jordan Tool & Machine Co., Elkhart, Ind.
Peck, Stow & Wilcox Co., Southington, Conn.
Rockford Iron Works, 846 Ray, Rockford, Ill.

PRISMS, Chandelier. See Crystals, Chandelier.

PROJECTOR LENSES. See Lenses.

PULLERS, Armature Shaft
Motor Pulley, Shaft & Pinion Pullers & Extractors.
Allen Electric & Equipment Co., Kalamazoo, Mich.
Big Buster. See Premier Elec. Co.
Crane Puller Co., Waltham, Mass.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Company, Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts Philadelphia, Pa.
Little Giant. See Premier Elec. Co.
Peerless. See Electric Service Supplies Co
Premier Electric Co., 1802 Grace, Chicago, Ill.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago Ill

PULLEYS, Composition
General Electric Co., Schenectady, N. Y.
Rockwood Mfg. Co., Indianapolis, Ind.
Sprucolite Co., Bloomfield, N. J.

PUMPS, Oil Burner
Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Milwaukee Tank Wks., Milwaukee, Wis.
Monroe Machine Tool Co., 737 W. Jackson Blvd., Chicago
Reflex. See Simplex Oil Heating Co.
Simplex Oil Heating Co., 1199 Eddy, Providence, R. I
Teesdale Mfg. Co., 427 Market, Grand Rapids, Mich.

PUMPS, Vacuum
To Exhaust Incandescent Lamps.
Beach-Russ Co., 50 Church, New York, N. Y.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Dunham Co., C. A., 450 East Ohio, Chicago, Ill.
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Eisler Elec. Corp., 756 S. 13th, Newark, N. J.
General Electric Co., Schenectady, N. Y.
Hubbard's Sons, Norman, 1 Carlton Ave., Brooklyn, N. Y.
Leiman Bros., 23 Walker, New York, N. Y.
Packard. See Hubbard's Sons, Norman.

PUNCHING PRESSES. See Presses, Punching.

PUNCHING and BENDING, Sheet Steel
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

RACKS, Wire Reel
(With Tension Device Attached).
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Elec'l Wks., P. E., 1829 Chouteau Ave., St. Louis, Mo. (Tensionless Dereeler)
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Elec. Co., Schenectady, N. Y. (Tension Indicator.)
Mutual Foundry & Machine Co., Atlanta, Georgia.
segur. See Electric Service Supplies Co.

RADIO CIRCUIT COMPONENTS
This heading includes Inductances (Coils), Capacitors (Condensers), Fixed Resistances, Grid Leaks, Transformers, Choke Coils, and Filters, also Amplifier Units and Kits.
Acme Appar. Corp., 39 Osborne, Cambridge, Mass.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero-Call. See Aero Products, Inc.
Aerovox Wireless Corp., 83 Washington, Brooklyn, N. Y
Aero Products, Inc., 4611 Ravenswood Ave., Chicago, Ill.
Air-King Products Co., 216 Wallabout, Brooklyn, N. Y.
Ajax Elec. Specialty Co., St. Louis, Mo.
Alden Mfg. Co., Springfield, Mass.
All-American Mohawk Corp., 4201 Belmont Ave., Chicago,
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Amerchoke. See American Transformer Co.
American Apparatus Co., Richmond, Ind.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
American Transformer Co., Newark, N. J
Amperite Rheostat. See Radiall Co.
Arco Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Arcjo. See Premier Elec Co.
Art Dial. See Pilot Radio & Tube Corp.
Audioformer Transformer. See Pacent Electric Co.
Autoformer. See Thordarson Elec. Mfg. Co.
Automatic Oil Heat Co., 9294 E. Fourth, St. Paul, Minn.
Automotive Parts Mfg. Co., 70 Washington St., Brooklyn,
B-Conomizer. See Pilot Radio & Tube Corp.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Bonine. See Turn-it Radio Sales.
Branston Co., Chas. A., 297 Washington, Buffalo, N. Y
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y
Browning-Drake Corp., Calvary, Waltham, Mass.
Buffer. See Aerovox Wireless Corp.
Buffalo. See De Jur-Amsco Corp.
Camfield. See Columbia Metal Products Co.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Capacigrad. See Pilot Radio & Tube Corp.
Cardwell Mfg. Corp., Allen D., 81 Prospect, Brooklyn, N. Y.
Carter Mfg. Co., 6300 Euclid Blvd., East Cleveland, O.
Carter Radio Co., 407 S. Aberdeen, Chicago, Ill.
Central Radio Corp., Beloit, Wis
Centraline. See Pilot Radio & Tube Corp.
Certified Condenser. See Radio Condenser Co.
Chelten Elec. Co., 4859 Stenton Ave., Philadelphia, Pa.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Clarostat Mfg. Co., 281 N. Sixth, Brooklyn, N. Y. (Radio Resistance.)
Cole Radio Mfg. Corp., 536 Bloomfield Ave., Bloomfield, N. J
Columbia Metal Products Co., 360 E. Grand Ave., Chicago.
Concertone. See Chicago-Jefferson Fuse.
Connectoralds. See Alden Mfg. Co.
Continental Carbon, Inc., Cleveland, O.
Continental. See Gardiner & Hepburn, Inc
Cornell Elec. & Mfg. Co., Anable & Rawson, Long Island City, N. Y
Cresgradio Corp., 166-32 Jamaica Ave., Jamaica, N. Y
Crefot. See Premier Elec. Co.
Daven Corp., 158 Summit, Newark, N. J. (Kits)
DeForest Radio Co., Jersey City, N. J.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Diamond Weave Coil. See Sickles Co., F. W.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Dubilier Condenser Corp., 342 Madison av., New York.
Dumont Elec. Co., 40 W. 17th, New York, N. Y.
Duratran. See Dubilier Condenser Corp.
Durham & Co., 1936 Market, Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Dynohmic. See Lynch, Inc.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I. (Kit.)
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill.
Electro Motive Engineering Corp., 127 W. 17th, New York
Elkay. See Langbein Kaufman Radio Co.
Elkon, Inc., 350 Madison Ave., New York, N. Y.
El Menco. See Electro Motive Engineering Co.
Equamatic Kit. See Karas Elec. Co.
Equitrol. See Cardwell Mfg. Corp.
E-Z. See Polymet Mfg. Corp.
Faradon. See Wireless Specialty Apparatus Co
Fast Co., John E., 3932 Barry Ave., Chicago, Ill.
Ferranti, Inc., 130 W. 42nd, New York, N. Y.
Filatrol. See De Jur-Amsco Corp.
Filtrola. See All-American Mohawk Corp.
Flechtheim Co., A. M., 138 Liberty, New York, N. Y.
Ford Radio & Mica Corp., 213 Bleecker, New York, N. Y
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind
F. & H. Radio Laboratories, Fargo, N. D.
Gardiner & Hepburn, Inc., 611 Widener Bldg., Philadelphia, Pa
General Instrument Corp., 225 Varick, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
General Transformer Corp., 910 W. Jackson Blvd., Chicago
General Winding Co., 214 Fulton, New York, N. Y.
Gen-Win. See General Winding Co
Ger-Ait Radio Laboratories, 859 Flatbush Ave., Brooklyn, N. Y. (Adapter.)
Glastor. See Daven Corp.
Globar Corp., Niagara Falls, N. Y.
Glo-Dial. See Wireless Radio Corp.
Gray & Danielson Mfg. Co., 260 1st, San Francisco, Cal
Halldorsen Co., 4745 N. Western Ave., Chicago, Ill.
Hamilton-Sangamo Corp.
Hammarlund Mfg. Co., 424 W. 33rd, New York, N. Y.
Hardwick, Hindle, Inc., 122 Greenwich, New York, N. Y.
Harmonik. See Karas Elec. Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. (TRF Kits.)
Heugenog Transformer. See Premier Elec. Co.
Heinemann Elec. Co., Trenton, N. J.
Held-Tite, Hi-ohm, Hi-pot. See Carter Radio Co.
Hi-Q Kit. See Hammarlund.
Hum-Dinger. See Clarostat Mfg. Co.
Hy-Wat. See Electro Motive Engineering Corp.
Igrad Condenser & Mfg. Co., 4322 Lake Ave., Rochester, N. Y.
Infra-Dyne. See Gray & Danielson Co.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa.
Isograd, Isoleak. See Pilot Radio & Tube Corp.
J-M-P. Mfg. Co., 5328 Fond du Lac Ave., Milwaukee, Wis.
Karas Elec. Co., 4040 N. Rockwell, Chicago, Ill.
Kelford. See American Specialty Co.
Kenyon Transformer Co., 122 Cypress Ave., New York, N. Y.
Kilograd. See Pilot Radio & Tube Corp.
Krobiack. See Mountford, C. E.
Kuprox. See Kodel Radio Corp.
Langbein-Kaufman Radio Co., 62 Franklin, New Haven, Conn.
Lavite. See Aerovox Wireles Corp.
Lautz Mfg. Co., 245 N. J. R. R. Ave., Newark, N. J. (Radio Resistance).
Lekeless. See Benjamin Elec. Mfg. Co.
Lemnis. See General Winding Co.
L. M. C. See Lauts Mfg. Co.
Loftin-White. See Hammarlund Mfg. Co.
Loless. See Wireless Radio Corp.
Lynch, Arthur H., 1775 Broadway, New York, N. Y.
Marco. See Martin-Copeland Co.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Maxitran. See Electrical Research Laboratories.
Mayolian Corp., 1443 Webster Ave., New York, N. Y. (Tone Filter.)
Meggit. See Cole Mfg. Corp.
Melco-Supreme. See De Jur-Amsco Corp.
Melcoupler. See Robertson-Davis Co.
Meloformer. See Robertson-Davis Co.
Metaleak. See Dubilier Condenser Corp.
Metralign. See General Instrument Corp.
Micadon Condenser. See Dubilier Condenser Corp.
Micacondenser. See Sterling Mfg. Co.
Microgrid. See Pilot Radio & Tube Corp.
Micrometric. See Karas Elec. Co.
Microstat. See Premier Elec. Co.
Midline. See Hammarlund Mfg. Co.
Modern Electric Mfg. Co., Toledo, O.
Mountford, C. E., 30 Sullivan, New York, N. Y.
Muter Co., Leslie F., 8440 S. Chicago Ave., Chicago, Ill. (Amplifier Kits.)
National Co., 61 Sherman St., Malden, Mass.
Neutro-Grad. See Pilot Radio & Tube Corp.
New York Coil Co., Mount Clare, Pa.
Nutmeg. See Hart & Hegeman Mfg. Co.
Ohio Carbon Co., 3215 Almira Ave., Cleveland, O.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill. (Resistance.)
One Way. See Carter Radio Co.
Orthometric. See Karas Elec. Co.
Orthophone. See De Jur-Amsco Corp.
Pacent Electric Co., 91 7th Ave., New York, N. Y.
Pam. See Samson Elec. Co.
Panatrol See Wireless Radio Corp.
Perry Elec'l Resistor Corp., 280 New Main St., Yonkers, N. Y.
Phastrol. See Electrad, Inc.
Philmore Mfg. Co., 106 7th Ave., New York, N. Y.
Plandier. See De Jur-Amsco Corp.
Pierce Airo. See United Scientific Laboratories.
Pilot Radio & Tube Corp., 323 Berry, Brooklyn, N. Y.
Pilotran. See Pilot Radio & Tube Corp.
Potter Mfg. Co., North Chicago, Ill.
Polymet Mfg. Corp., 829 E. 134th St., New York, N. Y.
Power Box. See Scott Sales Co.
Powerohm. See International Resistance Co.
Powrad, Inc., 121 Ingraham, Brooklyn, N. Y.
Precision Coil Co., 122 Greenwich, New York, N. Y.
Precise Mfg. Corp., 254 Mill, Rochester, N. Y.
Premier Elec. Co., 1802 Grace, Chicago, Ill.
Chicago, Ill.
Protectoraid. See Alden Mfg. Co.
Pyrohm. See Aerovox Wireless Corp.
Radiall Co., 50 Franklin, New York, N. Y.
Radio Appliance Corp., Springfield, Mass.
Radio Condenser Co., Thorn & Copewood, Camden, N. J.
Radio Engrg. Laboratories, 100 Wilbur Ave., Long Island City, N. Y (Short Wave Kit.)
Radioloc Switch. See Cutler-Hammer Mfg. Co.
Radio Receptor Co., 106 7th Ave., New York.
Radiostat. See Allen-Bradley Co.
Raola. See Modern Elec. Mfg. Co.
Rauland-Lyric. See All American Mohawk Corp.
Receptrad. See Radio Receptor Co.
Resonator. See F. & H. Radio Laboratories.
Regal. See American Specialty Mfg. Co.
Reliable Parts Mfg. Co., Wellington, O.
Remler. See Gray & Danielson Co.
Resistaformer. See Aerovox Wireless Corp.
Resistograd. See Pilot Radio & Tube Corp.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent) Hatheway & Co., 16 Hudson, New York, N. Y.
Roberts Condenser. See Hammarlund Mfg. Co.
Robertson-Davis Co., 412 Orleans, Chicago, Ill.
Samson Elec. Co., Canton, Mass. (TRF Kits.)
Scovill Mfg. Co., Waterbury, Conn.
Senior. See All American Mohawk Corp.
Sensory. See Heinemann Electric Co.
Sevison Magneto Engr. Co., 397 Phillips, Toledo, O.
Sickles Co., F. W., 130 Union, Springfield, Mass.
Signal Elec. Mfg. Co., Menominee, Mich.
Silver-Marshall, Inc., 6401 W. 65th St., Chicago. (Amplifier Kits.)
Silvertone. See Radio Receptor Co.
S. L. S. See Wireless Radio Corp.
S. L. T. See General Instrument Corp.
Somersolo. See DeForest Radio Co.
Splitmeter. See Premier Electric Co.
Sprague Specialties Co., Dept. M., Quincy, Mass.
Standard Transformer Co., Warren, O.
Sta-Put. See Martin-Copeland Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, O.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Submariner. See J-M-P Mfg. Co.
Super Multiformer. See Precise Mfg. Corp.
Supertran Transformer. See Ford Radio & Mica Co.
Symphony. See Modern Elec. Mfg. Co.
Synerodenser. See Precise Mfg. Corp.
Telemonic Coil. See Condenser Corp. of America.
Telos Coil. See Condenser Corp. of America.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago
Tobe Deutschman Co., Canton, Mass.

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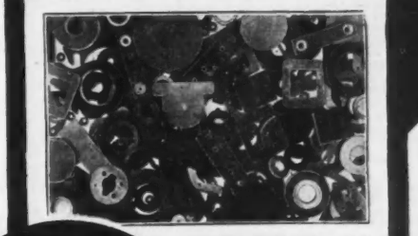
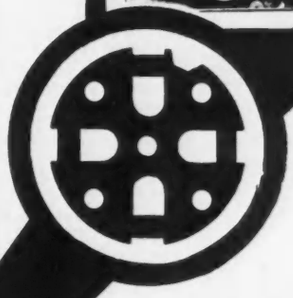
279—20th St., Brooklyn, N. Y.





FIBROC "BP"

for Economical High Speed Production

For those in the electrical field who fabricate their small insulating parts, FIBROC "BP" cold punching material has increased production and decreased manufacturing costs.

FIBROC "BP" is light in weight yet extremely tough and strong. It is unaffected by heat, moisture, or fumes, and does not warp nor change dimensions. It has all the workable qualities of hard fibre—yet none of its disadvantages such as warping, swelling, etc.

FIBROC "BP" has all the desirable characteristics of hot punching material but it does not require heating. In thicknesses up to 1/8" it may be punched cold at high speed with excellent results.

Write for more specific information or send your specifications for samples and prices.

FIBROC

FIBROC INSULATION CO.
245 Lincoln Avenue
VALPARAISO, INDIANA

RADIO CIRCUIT COMPONENTS—Continued
Tone Control. See Sprague Specialties Co.
Toroid. See All American Mohawk Corp.
Transcript-Clapp Kit. See Samson Electric Co.
Truphonic Amplification. See Alden Mfg. Co.
Tunadapta. See Lynch, Arthur H.
Tuway. See Carter Radio Co.
Twin-aud. See Peerless Radio Co.
Twin-Eight Transformers. See Bodine Electric Co.
Two-Ten & Two-Eleven. See Silver-Marshall.
Tyrman Elec. Corp., 314 W. Superior, Chicago, Ill.
Ultra Vario. See Bruno Radio Corp.
Univernier Condenser. See Auburn Button Works.
Universal Electro Chemical Corp., 30 W. 15th, New York.
Universal Winding Co., Boston, Mass.
Valley Appliances, Inc., 634 Lexington Ave., Rochester, N. Y.
Variall Condenser. See Muter Co.
Volta. See Universal Electro Chemical Corp.
Volumgrad. See Pilot Radio & Tube Corp.
Walbert Radio Corp., 1000 Fullerton Ave., Chicago, Ill.
Waterbury Button & Moulding Co., Waterbury, Conn.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn, N. Y.
Wireless Specialty Apparatus Co. (J. P.), Boston, Mass.

RADIO HARDWARE. See Radio Mountings.

RADIO MOUNTINGS

Coil Mountings, Coil Sliders and Rods, Switches, Detectors, Detector and Grid Leak Mountings, Panel Brackets, Special Radio Hardware & Trimmings, Metal Dials, Metal Panels, etc.

Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Alden Mfg. Co., Brockton, Mass.
American Emblem Co., Utica, N. Y.
American Radio Hardware Co., 135 Grand, New York.
Bonza. See Haydon & Haydon.
Carborundum Co., Niagara Falls, N. Y. (Detector.)
Chapman Machine Co., Terryville, Conn.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Durham & Co., 1936 Market, Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y. (Metal Panels.)
Eureka. See Morse Co Frank W.
General Etching & Mfg. Co., 3072 West Grand Ave., Chicago, Ill. (Metal Panels & Escutcheons.)
Globe Technolian Corp., Reading, Mass.
Glodial. See Wireless Radio Corp.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Haydon & Haydon, 167 Chambers, New York, N. Y.
Master Engineering Co., 122 S. Michigan Ave., Chicago, Ill.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 8440 S. Chicago Ave., Chicago.
Na-Ald. See Alden Mfg. Co.
Union Insulating Co., 296 Broadway, New York, N. Y.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO PANEL ENGRAVING. See Engraving, Radio Panel.

RADIO RECEIVER PARTS

Rheostats, Sockets, Plugs, Jacks.

Acme Elec. & Mfg. Co., 1652 Rockwell, Cleveland, Ohio.
Alden Mfg. Co., Springfield, Mass.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Amacostat. See American Apparatus Co.
American Apparatus Co., Richmond, Ind.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Automotive Equipment Co., 317 Halsey, Newark, N. J.
B. M. S. See Brooklyn Metal Stamping Corp.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. (Multiple Plugs.)
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Brach Mfg. Corp., L. S., 120 Sussex Ave., Newark, N. J.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn.
Cabelug. See Jones, Howard B.
Carter Radio Co., 407 S. Aberdeen, Chicago, Ill. (Also Socket Adapters.)
Central Radio Laboratories, 14 Keefe Ave., Milwaukee.
Centralab. See Central Radio Laboratories.
Clarostat Mfg. Co., 285 N. Sixth, Brooklyn, N. Y.
Cle-Ra-Tone. See Benjamin Elec. Mfg. Co.
D. A. Radio Co., 30 Hollister, Buffalo, N. Y.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
De Vaau. See Stanley & Patterson.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Duostat. See De Jur-Amsco Corp.
E-Z. See Polymet Mfg. Corp.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I.
Fantail Plug. See Brooklyn Metal Stamping Corp.
Frost, Herbert H., 1142 W. Beardsley, Elkhart, Ind.
Gem-Jac. See Frost, Herbert H.
General Instrument Corp., 225 Varick, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
Gray & Danielson Mfg. Co., 260 First, San Francisco, Cal.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Heinemann Elec. Co., Trenton, N. J.
Imp. See Carter Radio Co.
Jones, Howard B., 2300 Wabansia, Chicago. (Multiple Plug)
Kilmore Radio Corp., 1023 E. 178th, New York, N. Y.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Microgrid. See Pilot Radio & Tube Corp.
Modu-Plug. See Central Radio Lab.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 8440 S. Chicago Ave., Chicago.
Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Pacent Elec. Co., 91 Seventh Ave., New York, N. Y.
Pan-Tab Jack. See Frost, Herbert H.
Philmore Mfg. Co., 106 Seventh Ave., New York, N. Y.
Pilot Radio & Tube Corp., 323 Berry, Brooklyn, N. Y.
Polymet Mfg. Corp., 829 E. 134th St., New York, N. Y.
Premier Elec. Co., 1802 Grace, Chicago, Ill.
Recto Mfg. Co., 23 W. Third, Cincinnati, Ohio.
Robertson-Davis Co., 561 W. Superior, Chicago, Ill.
Royalty See Electrad, Inc.
Samson Elec. Co., Canton, Mass.
Socostat. See D. A. Radio Co.
Stanley & Patterson, 150 Varick, New York, N. Y.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio
Tubestat. See Muter Co.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO RECTIFIER TUBES

Armstrong Electric Co., 187 Sylvan Ave., Newark, N. J
Arcturus Radio Tube Co., 260 Sherman Ave., Newark, N. J
Cable Radio Tube Corp., 80 N. Ninth, Brooklyn, N. Y.
Ceco Mfg. Co., 1200 Eddy, Providence, R. I.
Conneway Elec. Laboratories, 490 Jefferson, Hoboken, N. J
Cunningham, Inc., E. T., 270 Seventh Ave., New York, N. Y
DeForest Radio Co., Franklin St. & Central Ave., Jersey City, N. J.
Diamond Electric Co., Newark, N. J.
Diamond Vacuum Products Co., 4053 Diversey Ave., Chicago
Eveready Raytheon. See National Carbon Co.
Gold Seal Electrical Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.

Hygrade Lamp Co., Salem, Mass.
Jaeger Research Laboratories, 280 Park Ave., Weehawken, N. J.
Ken-Rad Tube & Lamp Corp., Owensboro, Ky.
La Salle Radio Corp., Div. of Matchless Elec. Co., 1500 N. Ogden Ave., Chicago, Ill.
Manhattan Elecl. Supply Co., 510 Sixth Ave., New York.
National Carbon Co., New York, N. Y.
Neptron. See Hygrade Lamp Co.
Northern Mfg. Co., 357 Ogden, Newark, N. J.
Paramount Mfg. Co., 79 Orange, Newark, N. J.
Perryman Electric Co., 4901 Hudson Blvd., North Bergen, N. J.
Radio-Victor Corp. of America, 233 Broadway, New York.
Sonatron Tube Co., 1020 S. Central Park Ave., Chicago, Ill.
Specialty Appliance Co., 6611 Euclid Ave., Cleveland, Ohio.
Sylvania Products Co., Emporium, Pa.
Televocal Corp., 588 Twelfth, West New York, N. J.
United Radio & Elec. Corp., 500 Chancellor Ave., Irvington, N. J.

RADIO TRANSFORMERS. See Radio Circuit Components

RADIO TUBE BASE BRANDERS. See Engraving Radio Panel.

RADIO TUBE BASES. See Radio Molded Parts.

RADIO TUBE BULBS (Unfinished). See Bulbs, Glass.

RADIO TUBE PARTS

Filament Hooks, Screens, Bolts & Nuts & Special Stampings.

Juno Fasteners, Inc., Hillside, N. J.

RADIO WIRING HARNESS

Special wiring cable and harness assemblies for radio battery connections, radio tube adapter harness for converting battery operated receivers to A.C. operation; Socket Adapters for Power Tubes; Loud Speaker Extension Cords—This heading also includes auto ignition assemblies.

Afco. See American Fabric Co.
Ajax Elec. Specialty Co., 1231 Chestnut, St. Louis, Mo.
Alden Mfg. Co., Brockton, Mass. (Adapters.)
Alpbus. See Alpha Radio Supply Co.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Alpstrand. See Alpha Radio Supply Co.
American Braiding Co., Holyoke, Mass.
Belden Mfg. Co., 2510B S. Western Ave., Chicago, Ill.
Birnbach Radio Co., 254 W. 31st St., New York, N. Y.
Blue Ribbon. See Crescent Braid Co.
Brach Mfg. Co., L. S., Newark, N. J.
Connectoralds. See Alden Mfg. Co.
Cornish Wire Co., 30 Church, New York, N. Y.
Corwico. See Cornish Wire Co.
Crescent Braid Co., Providence, R. I.
Crescent Insulated Wire & Cable Co., Trenton, N. J.
De Luze, 50 W. Houston, New York, N. Y.
Diamond Braiding Mills, Chicago Heights, Ill.
Echo. See Cornish Wire Co.
Enterprise Mfg. Co., Third & Dauphin Sts., Philadelphia, Pa. (Adapters).
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind. (Adapters.)
Hatfield Rubber Wks., Inc., Hillside, N. J.
Lusterized. See American Braiding Co.
Manhattan Insulated Wire Co., 17 W. 60th St., New York.
Power, Inc., Harold J., Medford Hillside, Mass. (Adapters).
Radio Receptor Co., 106 Seventh Ave., New York, N. Y. (Adapters.)
Riga. See Birnbach Radio Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio. (Adapters).
Wilkens Mfg. Co., 52 Orawaupun St., White Plains, N. Y.

RADIUM POWDER AND PAINT

Radium Dial Co., 3332 Forbes, Pittsburgh, Pa.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y.

RANGE SWITCHES, Rotary Snap. See Switches, Snap, Heavy Duty.

RAWHIDE GEARS. See Gears & Pinions, Rawhide.

READING LAMP BASES. See Bases, Reading Lamp.

REAMERS, Pipe. See Stocks, Dies and Reamers.

RECEPTACLES, Lamp. See Sockets and Receptacles.

RECEPTACLES, Plug, Heavy Duty

	KEY
Battery Charging	See B
Floor Boxes	See F
Welding	See W
Machine Tool	See W
Watertight, Marine, Mine	See M
Car Trailer Connection	See C
Extension	See E

A. B. C. See Anderson Mfg. Co.
Adam Electric Co., Frank, St. Louis, Mo. F
Adapti Co., 2996 E. 72nd, Cleveland, O.. F
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass. B W M C E
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill. M
Arktite. See Crouse-Hinds Co.
Arnessen Electric Co., 13 Water, New York M
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn., F B W
Auth Electrical Specialty Co., 422 E. 53rd, New York, N. Y. E
Benjamin Elec. Mfg. Co., Des Plaines, Ill. F W M
Bryant Elec. Co., Bridgeport, Conn. (Also Range Type.) W
Campbell. See Steel City Elec. Co.
Cannon Elec. Development Co., 420 West Ave., 33, Los Angeles, Cal. F
C. E. M. Co. See Conn. Elec. Mfg. Co.
C. H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. M
Conduletto. See Crouse-Hinds Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. F
Cory & Son, Chas., 183 Varick, New York M
Crouse-Hinds Co., Syracuse N. Y. B W
Cutler-Hammer, Inc. 1288 St. Paul Ave., Milwaukee, Wis. F
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa. C
Elwell Parker Elec. Co., 4222 St. Clair Ave., N. E., Cleveland, O. B
Fielding. See Stanley & Patterson.

Gage List of
Electrical Buyers
The Trade Authority

Fountain's. See Jenkins Mfg. Co.
Fullman Mfg. Co., Latrobe, Pa. F
Fullman. See Steel City Elec. Co.
General Elec. Co., Merchandise Dept., Bridgeport, Conn. B
Gleason & Co., J. L., 241 Franklin, Boston, Mass. E
H. & H. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. B W
Hessei Co., W. F., 76 Greenwich, New York, N. Y. W M E
Hubbell, Inc., Harvey, Bridgeport, Conn. (Also Range Type.) B W
Indestructible. See Kliegl Bros. Universal.
Jenkins Mfg. Co., Bloomfield, N. J. E
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. F B W M
Latrobe. See Fullman Mfg. Co.
Lexington Electric Products Co., 12 Chapel, Newark, N. J.
Loefelholz & Co., Milwaukee, Wis. C
Major Equipment Co., 4603 Fullerton Ave., Chicago, Ill. M
Neco. See Novelty Elec. Co.
NePage McKenny Co., Seven Front, Seattle, Wash. F
Novelty Elec. Co., Tenth & Cherry Sts., Philadelphia, Pa. C
Ohio Elec. & Controller Co., 5903 Maurice Ave., Cleveland, Ohio W
Ostrander Elecl. Works, W. R., 911 Atlantic Ave., Brooklyn, N. Y.
Preset. See Walker Bros. Co.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill. W M C E
Quadrangle Mfg. Co., 32 S. Peoria, Chicago, Ill. (Combination wall bracket and convenience outlet.)
Raleo Mfg. Co., 123 N. Albany Ave., Chicago, Ill.
Russell & Stoll Co., 53 Rose, New York F B W M E
Square D. Co., Detroit, Mich. W
Stanley & Patterson, 150 Varick, New York, N. Y. F
Steel City Elec. Co., Pittsburgh, Pa.. F E
Thomas & Betts Co., 15 Park Place, New York, N. Y. F
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa. M
Walker Bros., 1417 Sansom, Philadelphia F E
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. F B W M
Yale. See Electric Products Co.

RECORDERS, Elapsed Time. See Indicators, Operation.

REDUCERS, Socket. See Socket Reducers.

REFLECTOR LENSES. See Lenses.

REFLECTORS, Porcelain Enameled, Steel

Bolite Reflector Co., 7500 Sherman Ave., Cleveland, O.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Cello, Inc., 84 Prince, New York, N. Y.
Dunlap Co., John, Carnegie, Pa.
Durex. See Wheeler Reflector Co.
Federal Electric Co., 8700 S. State, Chicago, Ill.
Goodlites. See Goodrich Elec. Co.
Goodrich Elec. Co., 1650 Ogden Ave., Chicago, Ill.
Isolux. See Wheeler Reflector Co.
Ivanhoe Division of Miller Co., Cleveland.
Jumbo. See Quadrangle Mfg. Co.
Marbelite Art Products Co., 140 N. Robey, Chicago, Ill.
Monk, H. E., 18 Warren, New York, N. Y.
Multi Elecl. Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Oamed. See Overbaugh & Ayers.
Overbaugh & Ayers, 411 S. Clinton, Chicago, Ill.
Para Steel. See Wheeler Reflector Co.
Perfection. See Tindall & White.
Philadelphia Elec'l & Mfg. Co., 1228 N. 31st, Philadelphia.
Quad. See Quadrangle Mfg. Co.
Quadrangle Mfg. Co., 32 S. Peoria, Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Sturdox. See Benjamin Elec. Mfg. Co.
Tindall & White, 33 W. 60th, New York, N. Y.
Vaporlux. See Wheeler Reflector Co.
Westinghouse Elec. & Mfg. Co., South Bend, Ind.
Wheeler Reflector Co., 275 Congress, Boston, Mass.

REFRIGERANTS. See Chemicals, Refrigeration.

REFRIGERATION CHEMICALS. See Chemicals, Refrigeration.

REFRIGERATOR CABINETS

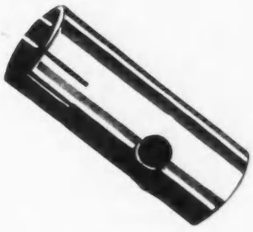
Airtite. See Rhinelander Refrigerator Co.
Alaska Refrigerator Co., Muskegon, Mich.
American Refrigerator Corp., Peru, Ind.
Arlington Refrigerator Co., Arlington, Vt.
Athermos. See Gurney Refrigerator Co.
Baldwin Refrigerator Co., Burlington, Vt.
Banta Refrigerator Co., Clearfield, Pa.
Belding-Hall ElectrICE Corp., Belding, Mich.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Bohn Refrigerator Co., St. Paul, Minn.
Cavalier. See Tennessee Furniture Co.
Challenge Refrigerator Co., Grand Haven, Mich.
Champion Refrigerator Co., 206 Lexington Ave., New York.
Crystal Refrigerator Co., Fremont, Neb.
Crystecl. See Benjamin Elec. Mfg. Co.
Dry-Air. See Baldwin Refrigerator Co.
Dry-Cold. See Hill & Co.
Eddy & Sons Co., D., 336 Adams, Boston, Mass.
Erie Art Metal Co. & Erie Metal Furniture Co., Erie, Pa.
General Necessities Corp., General Necessities Bldg., Detroit, Mich.
Gibson Refrigerator Co., Greenville, Mich.
Gloekler Co., Bernard, 1627 Penn Ave., Pittsburgh, Pa.
Gurney Refrigerator Co., Fond du Lac, Wis.
Harder Refrigerator Corp., Cobleskill, N. Y.
Haskelite Mfg. Co., 120 S. La Salle, Chicago, Ill. (Knockdown.)
Heintz Mfg. Co., Front & Olney Aves., Philadelphia, Pa.
Heinz & Munschauer, Superior and Randall, Buffalo, N. Y.
Herrick Refrigerator Co., 1805 River, Waterloo, Iowa.
Hibbard Cabinets, Inc., 6504 Euclid Ave., Cleveland, O.
Hill & Co., C. Y., 360 Pennington Ave., Trenton, N. J.
Holderle Bros., Inc., 329 Exchange, Rochester, N. Y.
Howe Scale Co., Rutland, Vt.
Jewett Refrigerator Co., Buffalo, N. Y.
Kingston. See Lorillard Refrigerator Co.
Kleen Kold. See Harder Refrigerator Corp.
Knox Products Co., Fourth & Greenhill Ave., Wilmington, Del.
Knox. See Erie Art Metal Co.
Leonard Refrigerator Co., Div. of Kelvinator Corp., Grand Rapids, Mich.
Liver & Co., C. B., Omaha, Neb.
Loeber Co., Henry G., 151 E. 126th, New York, N. Y (Ice Cream Cabinet.)
Lorillard Refrigerator Co., 44 Cooper Square, New York
Louisville Refrigerator Corp., 4460 Louisville Ave., Louisville, Ky.

FIBRE *"as is"* ... or anything made from fibre tubing as a base

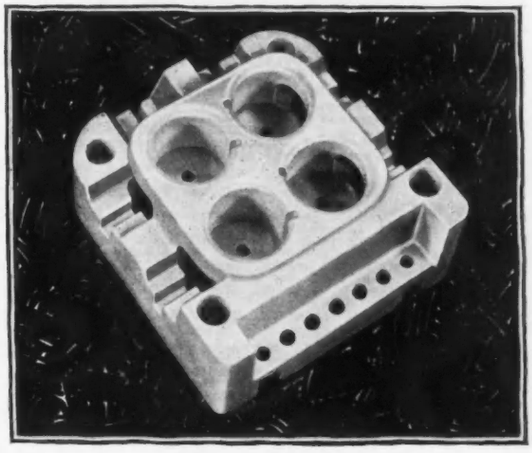
...we make it!

Brandywine service is comprehensive and specially keyed to the needs of electrical manufacturers. Starting with the finest and most uniform vulcanized fibre, our service goes on to include the forming and machining of anything that can be made from fibre tubing as a base. Unusual savings have been effected by the proper use of Brandywine fibre tubing; and we offer the most efficient production methods as our guarantee of work well-done, in jig-time and tallying exactly to your specifications.

BRANDYWINE FIBRE PRODUCTS CO.
1402 Walnut Street, Wilmington, Delaware

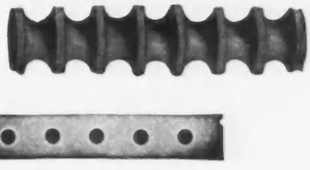


Brandywine FIBRE



"Quality"
Special Porcelain
Refractory Tubes for Every Purpose

COLONIAL INSULATOR CO.
Akron, Ohio *Established 1894*



Insulators *made of* LAVA

The heat resistant properties, combined with great dielectric strength, make Lava the accepted material for insulators incorporated in electric appliances.

AMERICAN LAVA CORPORATION
1425 William Street, Chattanooga, Tenn.
Manufacturers of Heat Resistant Insulators

Screw Machine Products

UP TO 2¼ in. DIAMETER

OLSON MFG. CO.
56 Commerical St.
WORCESTER, MASS.

REFRIGERATOR CABINETS—Continued
Louisville Tin & Stove Co., Louisville, Ky.
Lyon & Co., L. H., 55 E. 150th, New York, N. Y.
Maine Mfg. Co., Nashua, N. H.
McCray Refrigerator Sales Corp., 2864 Lake St., Kendallville, Ind.
Mowatt Refrigerator Co., 25 Oak Grove, San Francisco, Cal.
Omaha Fixture & Supply Co., 11th and Douglas, Omaha
Oreole. See Ottenheimer Bros.
Ottenheimer Bros., Baltimore, Md.
Plymeti. See Haskelite Mfg. Co.
Reni. See Ottenheimer Bros.
Reolite. See Ottenheimer Bros.
Rex Mfg. Co., Connersville, Ind.
Rexdale. See Rex Mfg. Co.
Rhinelander Refrigerator Co., Rhinelander, Wis.
Sanitary Refrigerator Co., Fond du Lac, Wis.
Schmidt Co., C., John and Livingston, Cincinnati, O
Seeger Refrigerator Co., St. Paul, Minn.
Sherer-Gillett Co., 601 W. Washington, Chicago, Ill.
Steeprest. See Heintz Mfg. Co.
Success Mfg. Co., Gloucester, Mass.
Tennessee Furniture Co., Chattanooga, Tenn.
Vogt. See General Necessities Corp.
Ward Refrigerator Co., 6901 S. Alameda, Los Angeles, Cal
White Mountain. See Maine Mfg. Co.
White Seal. See Louisville Refrigerator Co.

REFRIGERATOR CONDENSER UNITS. See Condenser Units, Refrigerator.

REFRIGERATOR FITTINGS

Commonwealth Brass Corp., 5781 Commonwealth Ave., Detroit, Mich.

REGULATORS, Temperature

American Radiator Co., 1807 Elmwood Ave., Buffalo, N. Y (Mercury Switch Type.)
American Telethermo Co., 1017 Summit, Toledo, O.
American Thermostat Co., 226 Jelliff Ave., Newark, N. J.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa. (Furnace.)
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Basel Mfg. Co., 911 Mulberry, Kansas City, Mo.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Ceaco. See Cobb Electric Appliance Co.
Cobb Electric Appliance Co., 100 Massachusetts Ave., Boston.
Cook Elec. Co., 2700 Southport Ave., Chicago, Ill.
Davis & Daggett Co., 238 Dwight, Springfield, Mass.
D. & T. Manufacturing Co., 3001 La Salle, St. Louis, Mo.
Electric Automatic Appliance Co., Denver, Col.
Engelhart, Chas., 90 Chestnut, Newark, N. J.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Gifford Heat Control Systems, 1 Broadway, New York.
Gold Car Htg. & Ltg. Co., 220 36th, Brooklyn, N. Y.
Hart Mfg. Co., Hartford, Conn.
Hermansen Elecl. Co., 505 W. 41st, New York, N. Y.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Jewell Mfg. Co., Auburn, N. Y.
Johnson Service Co., 149 Michigan, Milwaukee, Wis.
Lockswitch. See Time-O-Stat Controls Co.
Majestic Electric Appliance Co., San Francisco, Cal.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill. (Mercury Switch.)
Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave., Minneapolis, Minn.
Penn Electric Switch Co., Des Moines, Iowa.
Penn Heat Control Corp., 1207 Race, Philadelphia, Pa.
Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill
Protectostat. See Minneapolis-Honeywell Reflector Regulator Co.
Quick Freeze. See Penn Electric Switch Co.
Ranco. See Automatic Reclosing Circuit Breaker Co.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Simplex Heat Regulator, 2938 Pillsbury Ave., Minneapolis.
Snapon. See Taglialbue Mfg. Co.
Souder-Hornsby Co., Tamaqua, Pa.
Sure Fire. See Boston Machine Wks.
Taglialbue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Time-O-Stat Controls Co., Cramblet Engineering Div., 286 Milwaukee Ave., Milwaukee, Wis.
Trent Co., Harold E., 439 N. 12th, Philadelphia, Pa.
Webster Elec. Co., Racine, Wis.
White Mfg. Co., 2362 University Ave., St. Paul, Minn.
Wilcolator Co., Newark, N. J.
Wilson-MacLellp Co., 383 Concord Ave., New York, N. Y.

REGULATORS, Voltage

Ward-Leonard Electric Co., Mount Vernon, N. Y.
Rotor. See Ward-Leonard Electric Co.

RELAYS

(See also Circuit Breakers and Thermostats)
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Burke Controller Co., 369 Lexington Ave., New York, N. Y
Dunco. See Struthers Dunn, Inc.
General Electric Co., Schenectady, N. Y.
Leach Relay Co., 6931 Mission, San Francisco, Cal.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.

SCREW MACHINE PRODUCTS AND SPRINGS

for every purpose

WILLIAM STEINEN & COMPANY
297 Washington St. Newark, N. J.

Wilcolator Co., Newark, N. J.

REMOTE CONTROL SWITCHES. See Switches, Remote Control.

REMOVERS, Coil

Ewing Mfg. Company, Middleport, Ohio.

RESISTANCE
Boxes. See Instruments, Laboratory Standard
Coil Cores. See Cores, Resistance.
Test Sets. See Instruments.
Units, Radio. See Radio Circuit Components.
Units. See Units, Rods & Grids.
Wire. See Wire Bare.

RESISTORS

Lautz Mfg. Co., 245 N. J. R.R. Ave., Newark, N. J.
Ohmite Mfg. Co., 636 N. Albany Ave., Chicago, Ill.

RESISTORS. See Units, Rods & Grids.

RESURFACERS, Commutator. See Stones, Commutator, also Tools, Commutator Truing.

REVOLUTION COUNTERS. See Tachometers.

RHEOSTATS,
Motor-Controlling. See Controllers, also Rheostats
Radio. See Radio Receiver Parts.
Sewing Machine. See Controllers.

RHEOSTATS

KEY

Battery Charging ..... See B
Stage Dimming ..... See D
Meter Testing (Laboratory) ..... See L
Plating Tank ..... See P
Motion Pictures (Projector Lamp) ..... See M
Motor Starting, Field and Speed Regulating. See F

	F	B	D	P	M	L
Allen-Bradley Co., 494 Reed, Milwaukee						L
Biddle, James G., 1211 Arch, Philadelphia						L
Brach Mfg. Corp., L. S., Newark, N. J. (Radio Battery Control.)		B				
Bradleystat. See Allen-Bradley Co.						
Columbia Electric Mfg. Co., 1293 E. 52nd, Cleveland, O.				P		
Controlite. See Ward Leonard Elec. Co.						
Crown Rheostat & Supply Co., 1908 Maypole Ave., West Chicago, Ill.				P		
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.	F	B	D			L
Economic Rheostat Switch Co., 3351 N. 5th, Philadelphia, Pa.	F					
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.	F					
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O.		B				
General Electric Co., Schenectady, N. Y.	F					L
Hanson-Van Winkle-Munning Co., Matawan, N. J.				P		
Holzmuller, C. J., 1108 Howard, San Francisco, Cal.			D			
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y.			D		M	
Knoeller Elec. Co., De Pere, Wis.	F					
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago	F	B	D		M	L
Optimus. See Hanson-Van Winkle-Munning Co.						
Robertson, Leo F., Inc., 532 W. 22nd, New York, N. Y.					M	
Rubicon Co., 29 W. Sixth, Philadelphia, Pa.						L
Schaefer Bros. Co., 1059 W. 11th, Chicago		B				
Simplicity. See Cutler-Hammer Mfg. Co.						
Union Elec. Mfg. Co., 934 Juneau Ave., Milwaukee, Wis.	F					
Universal. See Ward Leonard Elec. Co.						
Vitrohm. See Ward Leonard Elec. Co.						
Ward Leonard Elec. Co., 31 South, Mt. Vernon, N. Y.	F		D		M	
Watton. See Electric Products Co.						
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.	F					W

RINGS Seal. See Packing.

RIVETS

American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Rivet & Specialty Co., 1830 S. 54th, Chicago, Ill
Hassall, Inc., John, 402 Oakland, Brooklyn, N. Y.
Hungerford Brass & Copper Co., Div. of The Chase Brass Companies, Inc., 88 Lafayette, New York, N. Y.
Manufacturers Belt Hook Co., 1315 W. Congress, Chicago, Ill
Nelson Rivet Co., Taunton, Mass.
Stimpson Co., Edwin B., 70 Franklin Ave., Brooklyn, N. Y
Thomson Mfg. Co., Judson L., Waltham, Mass.
Tubular Rivet & Stud Co., 87 Lincoln, Boston, Mass.
Waterbury Brass Goods Co., Waterbury, Conn.
Wright & Corson Mfg. Co., Bridgeport, Conn.

RODS, Resistance. See Units, Rods and Grids.

ROLLER BEARINGS. See Bearings, Ball and Roller

ROLLS, Coil Flattening

Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

RUBBER BELTS. See Belts, Rubber.

RUBBER, Hard

Hard Rubber, Ebonite, Vulcanite.
Aetna Rubber Co., 815 E. 79th, Cleveland, O.
American Hard Rubber Co., 11 Mercer, New York, N. Y
Connecticut Hard Rubber Co., West Haven, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Luzerne Rubber Co., Muirhead, near Dewey, Trenton, N. J.
Mahoganite. See American Hard Rubber Co.
New York Hard Rubber Turning Co., 212 Centre, New York
Panelyte Corp., Trenton, N. J.
Radiolite. See Superior Hard Rubber Co.
Stokes Rubber Co., Trenton, N. J.
Superior Hard Rubber Co., Butler, N. J.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Vulcanized Rubber Co., 251 4th Ave., New York, N. Y
Vulco Panels. See Vulcanized Rubber Co.

RUBBER, MECHANICAL GOODS

Goodrich Rubber Co., B. F., Akron, O.
Manhattan Rubber Mfg. Co., Passaic, N. J.
Republic Rubber Co., Youngstown, O.
Sun Rubber Co., Barberton, O.
Toycraft Rubber Co., Dept. W., Ashland, O.

RUBBER, SEMI-HARD. See Rubber Mechanical Goods.

RUBBER, Sponge

Sun Rubber Co., Barberton, O.
Toycraft Rubber Co., Dept. W., Ashland, O.

RUBBER TAPE. See Tape, Rubber and Friction
RUBBER TUBING. See Tubing, Rubber.
RUST PROOFING. See Plating & Finishing.
SAL AMMONIAC. See Chemicals, Battery.
SALTS, Battery. See Chemicals, Battery.
SATURATING TANKS. See Wire Manufacturing Machines
SCREW SHELLS, Socket. See Shells, Screw Socket.

SCREW DRIVING MACHINES

Vim Electric Tool Co., 149 Broadway, New York, N. Y.

Spray Finishing Fundamentals

By Paul W. Collins

The third of a series of articles on the subject.

Page 49

SCREW MACHINE PRODUCTS

Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh, Pa
American Metal Wks., 4865 Stanton Ave., Philadelphia, Pa.
Barnes Co., Wallace, Bristol, Conn.
Blake & Johnson Co., Waterbury, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Brighton Screw & Mfg. Co., 1456 Harrison Ave., Cincinnati, O.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Colonial-Premier Co., 225 W. Ohio, Chicago, Ill.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Hanson, Einar B., 17 Hermon, Worcester, Mass.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Indianapolis Screw Products Co., 621 N. Noble, Indianapolis.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Linden & Co., 891 Broad, Providence, R. I.
Meisel Press Mfg. Co., 944 Dorchester Ave., Boston, Mass
Olsen Mfg. Co., 56 Commercial, Worcester, Mass.
Pheoli Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Shimer & Sons, Samuel J., Milton, Pa.
Steiner & Co., 297 Washington, Newark, N. J.
Thomaston Mfg. Co., Thomaston, Conn.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Wilmington Fibre Specialty Co., Wilmington, Del.

SCREWS, Cap (Cut Thread)

Bristol Co., Waterbury, Conn.
Hartford Machine Screw Co., Hartford, Conn.

SCREWS, Drive

Parker-Kalon Corp., 190 Varick, New York, N. Y.

SCREWS, Machine

Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Elco Tool & Screw Corp., Rockford, Ill.
Hubbell, Inc., Harvey, Bridgeport, Conn.
New England Screw Co., Dept. A, 44 Farnsworth, Boston
Pheoli Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Strong, Carlisle & Hammond, 1392 W. Third, Cleveland, O

SCREWS, Machine (Cut Thread)

American Screw Co., Providence, R. I.

SECOHMMETERS. See Instruments, Laboratory Standard
SEGMENTS. See Discs, Armature.

SEPARATORS, Storage Battery

Baltimore Battery Separator Co., Baltimore, Md.
Campbell Elec. Co., Kansas City, Mo.
Carlile & Doughty, 2530 N. Broad, Philadelphia, Pa.
Chattanooga Battery Box Co., Chattanooga, Tenn.
Certified. See Ermet Products Co.
Ermet Products Co., Sherman Drive & 16th, Indianapolis, Ind. (Wood.)
Estes & Sons, E. B., 25 Vanderbilt Ave., New York. (Wood.)
Indianapolis Box & Separator Co., 1450 E. 19th St., Indianapolis, Ind. (Wood.)
Indianapolis Mfg. Co., Indianapolis, Ind.
Inseco. See Indianapolis Box & Separator Co.
Link & Hemrick, Inc., 555 W. 52nd, New York, N. Y
Red Band. See Indianapolis Mfg. Co.
Stewart Mfg. Co., Wm. E., 14th & Elm, Flint, Mich. (Wood.)
Wick Lumber Co., R., 539 W. 52nd, New York. (Wood.)

SHADES

Aluminum. See Shades, Metallic.
Asbestos. See Shades, Fabric.
Bamboo. See Shades, Fabric.
Brass. See Shades, Metallic.
Cast Metal. See Shades and Domes.
Copper. See Shades Metallic.
Cretonne. See Shades, Fabric.
Leaded. See Shades and Domes.
Leather. See Shades, Fabric.
Linen. See Shades, Fabric.
Mica. See Shades, Mica.
Molded. See Molded Insulation.
Mosaic. See Shades and Domes.
Paper. See Shades, Fabric.
Parchment. See Shades, Fabric.
Silk. See Shades, Fabric.
Stamped Metal. See Shades, Metallic; also Shades and Domes.
Steel. See Shades, Metallic.
Tin. See Shades, Metallic.
Zinc. See Shades, Metallic.

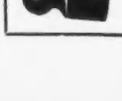
SHADES, Fabric

Asbestos Cretonne, Leather, Linen, Paper, Silk, Bamboo Parchment.

SCREW MACHINE PRODUCTS

in Brass or Steel

Send us your specifications for an estimate.



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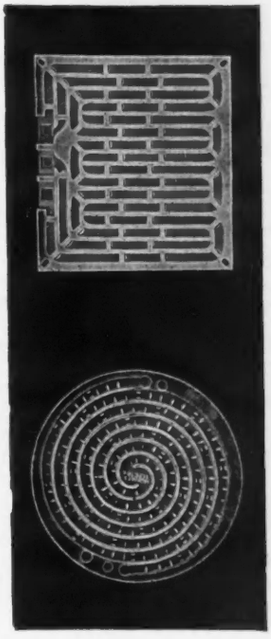

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Your customers take it for granted that motors, generators, transformers, or other products of your manufacture will give them efficient, dependable uninterrupted service.

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TRENTON NEW JERSEY

SHADES, Fabric—Continued
Acme Lamp Shade Co., 630 West Jackson Blvd., Chicago. (Silk.)
Adelphi Lamp Shade Co., 242 Fifth Ave., New York. (Silk.)
Admiration Lamp Shade Co., 160 Madison Ave., New York, N. Y. (Silk.)
Andrews Co., C. M., 32 E. 30th, New York, N. Y. (Silk.)
Art Lamp Shade Studios, 316 Fifth Ave., New York, N. Y.
Audrey Art Shade Studios, 105 Thatford Ave., Brooklyn.
Block & Co., L. D., 37 E. 18th St., New York, N. Y.
Borghese. See Hall, Chas.
Dalger Co., Charles V., 75 Essex, Boston, Mass. (Silk.)
Eastern Art Shop, 14 W. 19th, New York. (Parchment.)
Foss Parchment Shade Studio, 1338 E. 12th, Oakland, Cal. (Parchment.)
Foslite. See Foss Parchment Shade Studio.
Frostelene. See Art Lamp Shade Studios.
Gibson Art Co., 223 W. Fourth, Cincinnati, Ohio. (Paper.)
Hall, Chas., 3 E. 40th, New York, N. Y. (Paper Parchment.)
Hanson Co., Paul, 15 E. 26th, New York, N. Y. (Chintz.)
Harris Mfg. Co., 122 University Place, New York, N. Y. (Parchment.)
Herco Art Mfg. Co., Meriden, Conn.
Hoft Studio, 46 W. 21st, New York, N. Y. (Parchment.)
Idealite Elec. Lamp Shade Mfg. Co., 7 E. 17th, New York, N. Y. (Parchment.)
Kapa Shell. See Wardwell, E. H.
Kerwin. See Hall, Chas.
Kno-Glair. See Hamilton, M. E.
Lamb Bros. & Greene Corp., Napannee, Ind. (Silk.)
Luxrite. See John E. St. John.
Maxwell-Ray Co., Milwaukee, Wis. (Silk.)
Monarch Lamp & Shade Co., 210 N. Second, Philadelphia, Pa. (Silk.)
Morimura Bros., 58 W. 23rd, New York. (Bamboo, Silk, Cretonne.)
Parchment Novelty Co., 87 E. 10th, New York, N. Y. (Parchment.)
Patent Lamp Shade Co., 1361 Frankford Ave., Philadelphia.
Peerless Lamp Shade Mfg. Co., 114 E. 25th, N. Y. (Silk.)
R. D. Electric Co., Fort Wayne, Ind. (Linen and Silk.)
Reuter, Wm., 32 W. 34th, New York, N. Y. (Silk.)
Rindsberger Mfg. Corp., 18 E. 24th, Chicago, Ill.
Rosita Studio, 10 W. 28th, New York, N. Y. (Parchment and Leatherette.)
Sanderson's Art Co., Milwaukee, Wis. (Parchment.)
Springel & Son, A., 26 S. 3rd, Philadelphia, Pa.
St. John, John H., 1298 Atlantic Ave., Brooklyn, N. Y. (Silk.)
Straus-Hohenstein Co., 133 W. 21st, New York. (Silk.)
Superior Lamp Shade Manufacturers, 72 Madison Ave., New York, N. Y. (Silk.)
Tombs Studios, Wm. H., 172 Pennsylvania Ave., Newark, N. J. (Parchment Paper.)
Trio Mfg. Co., 610 N. American, Philadelphia, Pa. (Silk.)
Troy Art Studio, 624 2d Ave., Troy, N. Y.
Utility Shade Co., Tenafly, N. J.
Vogue Lamp & Shade Co., 130 W. 17th, New York, N. Y. (Parchment.)
Volkman & Co., 3223 W. Lake, Chicago, Ill.
Wardwell, E. H., 11 E. 36th, New York, N. Y.

SHADES AND DOMES

Leaded, Mosaic or Figured, Stamped or Cast Metal.
Art Shade Co., 224 N. Desplaines, Chicago, Ill.
Badanes Mfg. Co., 62 Greene, New York, N. Y.
Bayley & Sons, 105 Vanderveer, Brooklyn, N. Y.
Mutual Sunset Lamp Co., 21 E. Houston, New York, N. Y.
Western Art Glass Shade Works, 101 Turk, San Francisco.

SHADES, FACTORY WINDOW. See Window Shades, Factory.

SHADES, Metallic

Tin, Aluminum, Brass, Copper, Zinc, Steel.
A. A. Elec. Mfg. Co., Bridgeport, Conn. (Sole selling agent, Harry Pickhardt, 129 W. 15th, New York, N. Y.)
Durex. See Wheeler Reflector Co.
Faries Mfg. Co., Decatur, Ill. (Brass, Aluminum, Tin, Copper.)
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. (Aluminum, Brass, Zinc, Iron, Steel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Aluminum, Brass, Steel, Tin.)
Miller Co., Meriden, Conn.
Monk, H. E., 18 Warren, New York, N. Y. (Tin, Aluminum, Brass, Copper, Zinc & Steel).
Oamco. See Overbaugh & Ayres Mfg. Co.
Overbaugh & Ayres Mfg. Co., 411 S. Clinton, Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Western Reflector Co., 1221 W. Madison, Chicago. (Tin.)
Wheeler Reflector Co., 275 Congress, Boston, Mass.

SHADES, Mica

Hirsch Mica Co., 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
Kant-Krack. See Huse Liberty Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Tarmilite. See Tar Heel Mica Co.

SHAFT COUPLINGS. See Couplings, Shaft.
SHAFTS, Flexible. See Tubing, Flexible Metallic.

SHEARS, Insulation

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.

SHEET STEEL CABINETS. See Cabinets, Sheet Steel

SHELLS, Screw Socket

Chase Brass & Copper Co., Waterbury, Conn.
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
Patton-MacGuyer Co., Providence, R. I.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Torrington Mfg. Co., 70 Franklin, Torrington, Conn
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button & Moulding Co., Waterbury, Conn. (Miniature.)

SHUNTS, Instruments. See Instruments, Laboratory Standard.
SIGN FLASHERS. See Flashers, Sign.
SIGN LETTER LENSES. See Lenses.

SILICA

Ottawa Silica Co., Ottawa, Ill. "Flint Shot."

SILK, Cloth Insulated. See Cloth & Paper.
Shades. See Shades, Fabric.
Tape. See Tape.
Thread. See Yarn, etc.

SILVER, Metal and Wire

Baker & Co., Inc., 54 Austin, Newark, N. J.
Gilby Wire Co., Riverside Ave., Newark, N. J.

Fair Haven Marble & Marbleized Slate Co. SLATE
Fair Haven Vermont GOODS

PORTLAND-MONSON SLATE CO.
PORTLAND-MONSON SLATE CO. TRADE MARK PORTLAND, ME.
Quarriers of
Monson Slate
for Electrical
Purposes, Natural
Black, Oil Finish
Quarries:
Monson, Maine
Office, Portland, Maine

Handy & Harman, 57 William, New York, N. Y.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SILVER SOLDER. See Solder, Silver.

SINE WAVE OSCILLATORS. See Instruments, Laboratory Standard.

SIGN ELECTRODES, Gas. See Electrodes for Gas Signs.

SKINNERS WIRE. See Scrapers.

SLABS, Switchboard. See Asbestos Slabs; also Molded Insulation, Slate; Soapstone.

SLATE

For Switchboard Slabs and Barriers.
Davis Slate & Mfg. Co., 618 E. 40th, Chicago, Ill.
Electrical Specialties Corp., 50 Pearl, Boston, Mass.
Fair Haven Marble & Marbleized Slate Co., Fair Haven, Vt
Penrhyn Slate Co., Hydeville, Vt.
Portland-Monson Slate Co., Portland, Me.
Structural Slate Co., Pen Argyl, Pa.

SLEEVE-BEARINGS. See Bearings and Bushings.

SLEEVING, Cotton. See Tape, Cotton.

SLOTTING FILES. See Files, Commutator Slotting.

SLOTTING MACHINES and TOOLS, Commutator

(Mica Undercutters).
Allen Electric & Equipment Co., Kalamazoo, Michigan
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Hobart Bros. Co., Troy, Ohio.
Hullhorst Micro Tool Co., 3240 E. Monroe, Toledo, O.
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, Ohio.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn
Peerless. See Electric Service Supplies Co.
Ransom & Randolph Co., Superior & Chestnut, Toledo, Ohio
Simplex. See Weidenhoff, Joseph.
South Bend Lathe Works, 425 E. Madison, South Bend, Ind.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill
White Dental Mfg. Co., S. S., 152 W. 42nd, New York.

SNAP SWITCHES. See Switches, Snap

SOAPSTONE

For Switchboard Slabs and Barriers.
Alberene Stone Co., 153 W. 23rd, New York, N. Y.
Kirchberger & Co., Inc., 1425 37th, Brooklyn, N. J.
Lin-Stun. See Westinghouse.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa

SOCKET LININGS. See Linings, Socket.
SOCKET SHELLS. See Shells, Screw Socket.
SOCKETS, Flashing. See Flashers, Sign.

SOCKET Chain Attachments

Chain Links, Chain Adjusters, Acorns, Extensions, Insulated Chain Splicers.
Abbott. See Harvey Hubbell, Inc.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Bryant Electric Co., Bridgeport, Conn.
Duplex. See Warner Bros. Co.
Eade, John E., 104 Point, Providence, R. I. Links, Insulators.
Easylite. See Rittenhouse Co., A. E.
Economy. See Harvey Hubbell, Inc.
Flory, Wm. E., 38 W. 32nd, New York, N. Y. (Decorative Pull Chains.)
Gripper. See Wittenberg Bros.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. (Metal Pull Tassel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Links and Acorns. Metal Pull Tassels.)
Paiste. See Hart & Hegeman Mfg. Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y. (Pull Chain Tassel.)
P. & S. See Pass & Seymour, Inc.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Royal. See Sears, Henry D.
Scovil Mfg. Co., Waterbury, Conn. (Acorn.)
Sears, Henry D., 50 Boylston, Boston, Mass.
Waterbury Brass Goods Co., Waterbury, Conn. (Acorns.)
Weber. See Sears, Henry D.
Wittenberg Bros., 60 Shipman, Newark, N. J. Links, Insulators.

SOCKET REDUCERS

Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Can-del-lite. See Sears, Henry D.
Eagle Electric Mfg. Co., 59 Hall, New York, N. Y.
Electric Co., 94 Allyn, Hartford, Conn.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Hart & Hegaman Div. of Arrow-Hart & Hegeman Elec. Co. Hartford, Conn.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Propp Co., M., 524 Broadway, New York, N. Y.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sears, Henry D., 80 Boylston, Boston, Mass.

SOCKETS, Radio. See Radio Receiver Parts.

SOCKETS AND RECEPTACLES, Lamp

Bases other than Standard (or Medium) are indicated as follows: Mogul, M; Candelabra (or Miniature), C.

Key	See K
Composition	See W
Metal Shell	See B
Porcelain	See A
Pull Chain	See P
Push Through	See T
Sign Receptacles	See A

A. B. C. See Leviton Mfg. Co.

Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. . . . . A
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo. . . . . W
Alabax. See Arrow Elec. Co.
Alcor Mfg. Co., 4605 W. Madison, Chicago, Ill. C
Appleton Electric Co., 1730 Wellington Ave., Chicago, Ill. . . . . A
Armstrong & White, 9th and Liberty Ave., Pittsburgh, Pa. . . . . A
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. M C K T P B A
Arrogrip. See Arrow Elec. Co.
A. & W. See General Outdoor Adv. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. . . . . C . . . . P B .
Best. See United States Elec. Mfg. Corp.
Bryant Elec. Co., Bridgeport. . . . . M C K T P B A
C-H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. . . . M . . K T P B A
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. . . . . .
Connecticut Elec. Mfg. Co., Bridgeport, Conn. . . . . M . . K T . . B A
Crouse-Hinds Co., Syracuse, N. Y. . . A W . . . . . .
Cutler-Hammer, Inc., 1287 St. Paul Ave., Milwaukee, Wis. . . . . K T . . B A
Durex. See Wheeler Reflector Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. . . . . .
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. . . . . P B . .
Far-Go Elec. Mfg. Co., 388 Broome, New York, N. Y. . . . . C . . . . . .
Federal Electric Co., 3700 S. State, Chicago, Ill. . . . . A
Flute. See Pass & Seymour.
Flutelier. See Pass & Seymour.
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. . . . . M C . . . . . B . .
Gaynor Elec. Co., Bridgeport, Conn. . . . . .
General Elec. Co., Merchandise Dept., Bridgeport, Conn. . . . . M C K T P B A
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. . . . . M C K T P B A
Hoosick Falls Radio & Elec'l Parts Mfg. Co., Hoosick Falls, N. Y. . . . . W . . . . . .
Horan Co., E. S., 550 Monroe, Carlstadt, N. J. . . . . A
Hubbell, Inc., Harvey, Bridgeport, Conn. M C K T P B A
H. & H. See Hart & Hegeman.
I-D-A. See Watson Mfg. Co., J. E.
K-E Cleat Receptacle. See Kirkman.
Kirkman Engineering Co., 1 Dominick, New York. (Cleat Receptacle.) . . . . . .
Leader. See Leviton Mfg. Co.
Leiser & Co., W. A., 1607 Sansom, Philadelphia, Pa. . . . . A
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y. . . . . M C K . . P B A
Levolier. See McGill Mfg. Co.
Liberty Bell. See Hart & Hegeman.
Locat-A-Catch. See Connecticut.
McGill Mfg. Co., Valparaiso, Ind. . . . . P B A
Majestic Elec. Mfg. Co., 806 N. 12th, St. Louis. (Lamp Receptacle.) . . . . . A
Molded Socket Corp., Railroad, Pa. . . . . K . . . . . .
Multi Elec'l Mfg. Co., 1840 W. 14th, Chicago, Ill. . . . . A
Multilok. See Circle F Mfg. Co.
Newgard. See Multi Elec'l Mfg. Co.
New Wrinkle. See Bryant Elec.
Noark. See Colt's Patent Fire Arms.
One 4 All. See Propp Co., M.
P. & S. See Pass & Seymour.
Pass & Seymour, Solvay Station, Syracuse, N. Y. . . . . M C K T P B A
Paulding, John I., New Bedford, Mass. . . . . B A
Perkins. See Bryant Elec. Co.
Porcelain Products, Inc., Findlay, O. . . . . A
Propp Co., M., 524 Broadway, New York, N. Y. . . . . .
Quick Catch. See Hubbell, Inc.
Royal. See Sears, Henry D.
Ryan Appliance Co., 117 Mulberry, Trenton, N. J. . . . . W . . . . . A
Saftl Soc. See Molded Socket Corp.
Sears, Henry D., 80 Boylston, Boston M C K T P B A
Security. See Circle F Mfg. Co.
Shurlock. See Pass & Seymour.
Siemen Co., Bridgeport, Conn. . . . . .
Taplet Mfg. Co., 3709 Powelton Ave., Philadelphia, Pa. . . . . A
Titan. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. . . . . A
Union Insul. Co., Parkersburg, W. Va. . . . . .
United States Elec. Mfg. Corp., 222 W. 14th, New York, N. Y. . . . . P . . B . . W
U. S. Electric Co., 311 Chambers St., Trenton, N. J. . . . . A
Waleo. See Leiser & Co., W. A.
Waterbury Button & Moulding Co., Waterbury, Conn. . . . . .
Watson Mfg. Co., J. E., 5506 N. Fifth, Philadelphia, Pa. (Concealed Fixture) . . . . . P B . .
Weber. See Sears, Henry D.
Wheeler Reflector Co., 275 Congress St., Boston, Mass. . . . . P . . . .
Wood Electric Co., C. D., 565 Broadway, New York. (Sign Receptacles.) . . . . . A
Woodwin. See Wood Elec. Co.
Wrinklet. See Bryant Elec. Co.

SOLDER, Aluminum

Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill
Aluminum Solder Corp. of America, 730 Fifth Ave., New York, N. Y.
Lasher-Weeber Co., 261 Franklin, Boston, Mass.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Platt Bros. & Co., Waterbury, Conn.
Solderlume. See Aluminum Solder Corp. of America
Supreme. See Lasher-Weeber Co.
Union Smelting & Refining Co., Newark, N. J.
Usarco. See Union Smelting & Refining Co.

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Eagle. See Hoyt Metal Co.

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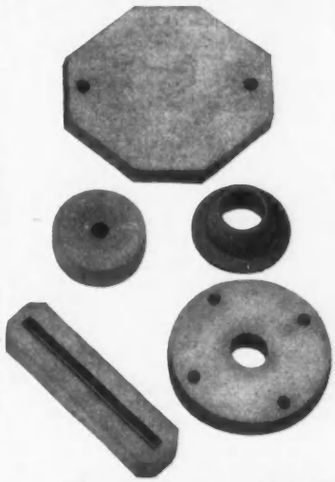

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American Solder & Flux Co., 2910 N. 16th, Philadelphia.
Dutch-Boy. See National Lead Co.
Gardiner Metal Co., 1366 W. Lake, Chicago, Ill.
Kester Solder Co., 4210 Wrightwood Ave., Chicago, Ill.
Lenk Mfg. Co., 32 Merrimac, Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
Silva-Wares, Inc., 134 W. 26th St., New York, N. Y.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Tinol. See American Solder & Flux Co.

SOLDER, Silver

Handy & Harman, 57 William, New York, N. Y.
Wilson Co., H. A., Newark, N. J.

SOLENOIDS. See Coils, Finished.

SOLDERING
Compounds. See Soldering Compounds.
Irons. See Soldering Irons.
Machines. See Soldering Machines, Commutator Tools. See Torches and Furnaces.

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Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill. (Soldering, Stick Paste, Salts, Liquid Oil, Welder, Aluminum Flux, Fountain Brushes.)
American Solder & Flux Co., 2910 N. 16th, Philadelphia, Pa. Flux, Paste, Salts.
Amco. See American Solder & Flux Co.
Anchor. See Garden City Laboratory.
Benson Co., Alex R., Hudson, N. Y. (Salts and Paste.)
Burnley Battery & Mfg. Co., North East, Pa. Paste and Stick.
Brulmer Chemical Wks., 217 E. 3rd, Cincinnati, O.
Callahan & Co., Geo., 318 Front, New York. (Fluid.)
Central Stamping Co., 206 Broadway, New York, N. Y. Paste and Salts.
Challenge. See Highland Electro Chemical Co.
Conductalute. See Technical Products Co.
Crescent. See McGill Mfg. Co.
Diamond. See Burnley Battery & Mfg. Co.
Dielectric Mfg. Co., St. Louis, Mo.
Dunton Co., M. W., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Eureka. See Grasselli Chemical Co.
Fluxite. See Monarch Products Co.
Garden City Laboratory, 300 W. Adams, Chicago, Ill.
General Elec. Co., Merchandise Dept., Bridgeport, Conn. (Paste).
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Highland Electro Chemical Mfg. Co., Connellsville, Pa. (Paste, Stick, Salts.)
Incomparable. See Reade Mfg. Co.
Leveridge, Inc., Chas. W., 246 Fulton, New York, N. Y.
Luco. See Lukens Metal Co.
Lukens Metal Co., T. F., 1105 Fairmount Ave., Philadelphia, Pa.
McGill Mfg. Co., Valparaiso, Ind. Fluid.
Mitchell-Rand Mfg. Co., 19 Vesey, New York. (Paste.)
Monarch Products Co., Red Bank, N. J.
Neutral. See Dielectric Mfg. Co.
New-Idea. See Hartwig Co., Wm. J.
Nokorode. See Dunton Co., M. W.
Oakwood. See Weaver Specialty Co.
Paragon Insulating Co., 5716 Euclid Ave., Cleveland, O.
Pfanstiehl Chemical Co., Waukegan, Ill. Paste, Salts, Sticks, Fluid, Oil, and Solid Sal Ammoniac.
Queens. See Brunner Chemical Works.
Reade Mfg. Co., 133 Hoboken Ave., Jersey City, N. J. (Fluids, Salts, Paste).
Redens. See Reade Mfg. Co.
Red-Letter. See Ruby Chemical Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y. (Paste.)
Rotar Mfg. Co., 380 E. 133rd, New York, N. Y.
Ruby Chemical Co., Columbus, O.
Ruby Fluid. See Ruby Chemical Co.
Salbrick. See American Solder & Flux Co.
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. (Paste.)
Snowflake. See Grasselli Chemical Co.
Snowflake. See Highland Electro Chemical Co.
Solderine. See Central Stamping Co.
Solderite, Inc., 22 Green, Newark, N. J.
Speco. See Pfanstiehl Chemical Co.
Standard. See Grasselli Chemical Co.
Star. See McGill Mfg. Co.
Superior. See Highland Electro Chemical Co.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa. (Paste.)
Tinol. See American Solder & Flux Co.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago, Ill.
Weaver Specialty Co., 6344 Aurelia, Pittsburgh, Pa.
Yager's. See Benson Co., Alex. R.
Yankee. See Leveridge, Inc., Chas. W.

SOLDERING IRONS

Acme Elec. Heating Co., Dept. R, 1217 Washington, Boston.
Adroit. See Adrola Corp.
Adrola Corp., Port Jefferson, N. Y.
American Beauty. See American Elecl. Heater Co.
American Elecl. Heater Co., Detroit, Mich.
B-D. See Bleadon-Dun Co.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beckwith Machine Co., 402 N. Chestnut, Ravenna, Ohio.
Betsy Ross. See Central Flatiron Mfg. Co.
Bleadon-Dun Co., 2300 Warren Ave., Chicago, Ill.
Brach Mfg. Corp., L. S., Newark, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Central Flatiron Mfg. Co., Johnson City, N. Y.
Chapman Machine Co., Terryville, Conn.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Davis Specialty Works, East Gary, Ind.
Dominion Elec'l Mfg. Co., 712 Ontario Ave., N., Minneapolis.
Dover Mfg. Co., Dover, O.
Drake Elec. Wks., 3943 Lincoln Ave., Chicago, Ill.
Edison Elec. Appliance Co., 5600 W. Taylor, Chicago, Ill.
Electrahot Mfg. Co., 525 S. 4th, Minneapolis, Minn.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland. (Transformer Soldering Outfit.)
Electric Soldering Iron Co., Inc., 135 W. 17th, New York.
Electrical Products Mfg. Co., Providence, R. I.
Enco. See Electrical Necessities Corp.

Esico. See Electric Soldering Iron Co.
Everhot. See Swartzbaugh Mfg. Co.
Ever-Ready. See Gold Seal Elec. Co.
General Electric Co., Schenectady, N. Y.
Gold Seal Elecl. Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
Home. See Majestic Elec. Appliance Co.
Illinois Stamping & Mfg. Co., 220 N. Jefferson, Chicago, Ill.
Industrial. See Permway Mfg. Co.
Jiffy. See Koch & Co., Paul W.
Junior. See Drake Elec. Wks.
King. See Electric Heat Control Co.
Koch Co., Paul W., 23 S. Wells, Chicago. (Solder Dipper).
Landers, Frary & Clark, New Britain, Conn.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Lotan. See Simplex Flux & Solder Co. of America.
Lucifer. See Jones Point Tool & Elec. Co.
Majestic Electric Appliance Co., San Francisco, Cal.
Manning-Bowman & Co., Meriden, Conn.
Mechanics. See Drake Elec. Wks.
Moto-Ray Mfg. Co., 169 Massachusetts Ave., Boston, Mass.
National Specialties Co., Howell & Tyler Sts., Fort Wayne, Ind.
Northern Elec. Co., 2833 N. Western Ave., Chicago, Ill.
Queen Quality. See Watlow Elec. Mfg. Co.
Quick-Hot. See Moto-Ray Mfg. Co.
Radio. See Drake Elec. Wks.
Red Bird. See Security Electric Mfg. Co.
Regular. See National Specialties Co.
Reliance. See Landers, Frary & Clark.
Samson Cutlery Co., 8 Jones St., Rochester, N. Y.
Security Elec. Mfg. Co., 2635 Canton, Chicago, Ill.
Silver King. See Illinois Stamping & Mfg. Co.
Simplex Flux & Solder Co. of America, 1965 E. 66th, Cleveland, O.
Superior Elec. Products Corp., 1300 S. 13th, St. Louis, Mo.
Swartzbaugh Mfg. Co., 1501 W. Bancroft, Toledo, O.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trent, Harold E., 295 N. Lawrence, Philadelphia, Pa.
Varick Elec. Mfg. Co., 28 E. 21st St., New York, N. Y.
Vulcan Elec. Heating Co., 225 Varick, New York, N. Y.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago, Ill.
Ward Mfg. Co., 937 Wellington Ave., Chicago, Ill.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Wellmade Elec. Co., Torrington, Conn.

SOLDERING MACHINES, Commutator

(For production soldering of small commutators).
Allstonce. See Chapman Electric Works, P. E.
Chapman Electric Works, P. E., 1220 Chouteau Ave., St Louis, Mo.

SOLENOIDS. See Coils

SOLVENTS & REDUCERS, VARNISH. See Paint, Varnish, Lacquer.

SPAGHETTI. See Tubing, Varnished Fabric.

SPEED CHANGING UNITS. See Gears (Speed Changing Units).

SPEED INDICATORS. See Tachometers.

SPOOLING MACHINES, WIRE. See Wire Manufacturing Machines.

SPRAYING OUTFITS

Airway. See Chicago Utilities Corp.
Babco. See Simons Paint Spray Brush Co.
Beach Air Brush Co., Willard C., Harrison, N. J.
Chicago Utilities Corp., 3120 Carroll Ave., Chicago, Ill.
De Vilbiss Mfg. Co., 3750 Detroit Ave., Toledo, Ohio.
Eclipse Air Brush Co., 79 Orange, Newark, N. J.
Electric Sprayit Co., 820 E. Colfax Ave., South Bend, Ind
Eureka Sprayers, Inc., 87-28 130th, Long Island City, N. Y.
Ideal Air Brush Mfg. Co., 203 Lafayette, New York, N. Y
Kellogg Mfg. Co., 97 Humboldt, Rochester, N. Y.
Koch Bros. Mfg. Co., 2339 Nelson, Chicago, Ill.
K B. See Koch Bros. Mfg. Co.
Metal Specialties Mfg. Co., 338 N. Kedzie Ave., Chicago.
Macleod Co., 2232 Bogen, Cincinnati, O.
Paasche Air Brush Co., 1909 Diversey Parkway, Chicago, Ill.
Pioneer Air Compressor Co., 243 Canal, New York, N. Y.
Presto. See Metal Specialties Mfg. Co.
Reliable Mfg. Co., Dwightway & Fourth St., Berkeley, Cal.
Simons Paint Spray Brush Co., 17 Maryland Ave., Dayton, O.
Simplex Spray Equipment Co., 552 W. Lake, Chicago, Ill
Spray-All. See United States Air Compressor Co., 5300 Harvard Ave., Cleveland, Ohio.
Sprayit. See Electric Sprayit Co.
United States Air Compressor Co., 5300 Howard Ave., Cleveland, O.
Wold Air Brush Mfg. Co., 2173 N. California Ave., Chicago, Ill.

SPREADERS, COIL & LOOP. See Winding Machines Armature & Field Coil.

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Barnes-Gibson-Raymond, Inc., 6400 Miller Ave., Detroit, Mich.
Cary Spring Works, Inc., 240 W. 29th St., New York, N. Y
Chapin Co., Chas. E., 227 Fulton, New York, N. Y.
Cleveland Wire Spring Co., Cleveland, O.
Cook Spring Co., Ann Arbor, Mich.
Cuyahoga Spring Co., Berea Rd., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Eureka Tinware Mfg. Co., 135 W. 20th, New York, N. Y.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Gibson Co., Wm. D., 1800 Clybourn Ave., Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Lee Spring Co., 34 Main, Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge, Brooklyn, N. Y
Hunter Pressed Steel Co., Landsdale, Pa.
Newcomb Spring Corp., 234 40th, Brooklyn, N. Y.
Peck Spring Co., Plainville, Conn.
Peterson Spring Co., 1660 Beard Ave., Detroit, Mich.
Rapid Spring Co., 222 Second Ave., Pittsburgh, Pa.
Raymond Mfg. Co., Corry, Pa.
Standard Spring and Manufacturing Co., 236-42nd St. Brooklyn, N. Y.
Steinen & Co., 297 Washington, Newark, N. J.
Wallace Barnes Co., Bristol, Conn.
Young Industries, Inc., L. A., Detroit, Mich.

STAMPED BOXES. See Cabinets, Sheet Steel.

STAMPINGS, Fibre. See Fibre.
Sheet Metal. See Fixture Fittings.
Sheet Steel. See Stampings, Sheet Steel.
Small. See Stampings, Small.

STAMPINGS, Sheet Steel

Heavy Stamping and Drawing.
Acklin Stamping Co., 1925 Nebraska, Toledo, O.
American Stamping Co., 978 E. 64th, Cleveland, O.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bossert Corp., Utica, N. Y.
Eureka Tinware Mfg. Co., 135 W. 20th, New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Hubbard & Co., Pittsburgh, Pa.
Janney, Steinmetz & Co., 1421 Chestnut St., Philadelphia
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn.
Mullins Mfg. Corp., Washing Machine Division, Salem Ohio. (Vitreous Enameled)
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
Truscon Steel Co., Youngstown, O
United States Stamping Co., Moundsville, W. Va.

STAMPINGS, Small

Small Stamped Metal Parts for Electrical Devices.
Advance Tool & Die Casting Co., 1654 Holton, Milwaukee
Aerial Machine & Tool Co., 79 Grand, New York, N. Y.
American Radio Hardware Co., 135 Grand, New York, N. Y
American Stamping Co., 978 E. 64th, Cleveland, O.
Arrow Automatic Products Corp., 27 Vestry, New York, N. Y.
Barnes Co., Wallace, Bristol, Conn.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Bull Dog Electric Products Co., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
Clarke Metal Products, Inc., 490 Hancock Ave., Bridgeport Conn.
Elco Tool & Screw Corp., Rockford, Ill.
Eureka Tool & Machine Co., Newark, N. J
Faries Mfg. Co., Decatur, Ill.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros. Co., Plano, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Lansing Stamping Co., Lansing, Mich.
Lenz Metal Stamping Wks., J., 199 Franklin, New York
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Mechanics Tool & Stamping Co., 7 Summer, Worcester, Mass
Mutual. See Bull Dog Elec. Products Co.
Patton-MacGuyer Co., Providence, R. I.
Paul & Beekman Mfg. Co., 1734 N. Fifth, Philadelphia, Pa
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn
Precision Metal Workers, 3100 Carroll Ave., Chicago, Ill
Premax Products, Inc., Niagara Falls, N. Y.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Signal Elec. Mfg. Co., Menominee, Mich.
Soss Mfg. Co., Roselle, N. J.
Steinen & Co., 297 Washington, Newark, N. J.
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
United Stamping & Mfg. Co., Cleveland, Ohio.
United States Stamping Co., Moundsville, W. Va.
Valley Appliances, Inc., 634 Lexington Ave., Rochester, N. Y.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button & Moulding Co., Waterbury, Conn.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Waterbury Metal Wares Co., Waterbury, Conn.
Western Cartridge Co., East Alton, Ill.
Zierick Machine Wks., F. R., 68 E. 131st St., New York, N. Y.

STANDS, Armature

Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17 & Cambria Sts., Philadelphia, Pa.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

STARTERS, Motor. See Controllers, Motor; Switches, Remote Control; Switches, Knife; Safety; Switches, Snap (Heavy Duty).

STEATITE. See Cores, Resistance Coil.

STEEL CASTINGS. See Castings, Steel.

STEEL for Electric Appliances

Elyria Iron & Steel Co., Elyria, O.
Ryerson & Son, Jos., 2558 W. 16th, Chicago, Ill.

STEEL, Magnet

Ajax Electrothermic Corp., Trenton, N. J.
Hercules Elec. Steel Corp., 145 Lafayette St., New York.
Indiana Steel Products Co., 4545 S. Western Ave., Chicago
Ludlum Steel Co., Watervliet, N. Y.
Reed Co., Jr., David, 85 Adams, Brooklyn, N. Y.
Swedmag. See Reid Co., Jr., David.

STEEL SHEETS

Agathon. See Central Alloy Steel Corp.
Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middleton, Ohio.
American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh
Armco. See American Rolling Mill Co.
Armelec. See Empire Steel Corp.
Central Alloy Steel Corp., Massillon, O.
Cyclops Steel Co., Titusville, Pa.
Dynelec. See Empire Steel Corp.

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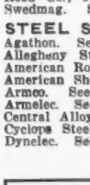

THE CHAS. FISCHER SPRING COMPANY
Springs of every description. Flexible Shafts. Metal and Wire Specialties. Write for prices
238 KENT AVE., BROOKLYN, N. Y.

This Seal Makes Selling Easier

The Cooke Seal Ring on your product will prove a strong sales point. Used in place of old-fashioned packing it takes the place of periodic repackings, thus saving material costs and dollars lost from shut downs for repacking. Leak proof, it checks the loss of valuable or destructive liquids. Running smoothly against the gland face it eliminates costly replacements of scored shafts or sleeves. Almost frictionless, it saves expensive power. These are just a few reasons why Cooke Seal Rings are being installed everywhere. If you have a sealing problem of any kind we can solve it. Write us for details.

COOKE Seal Ring

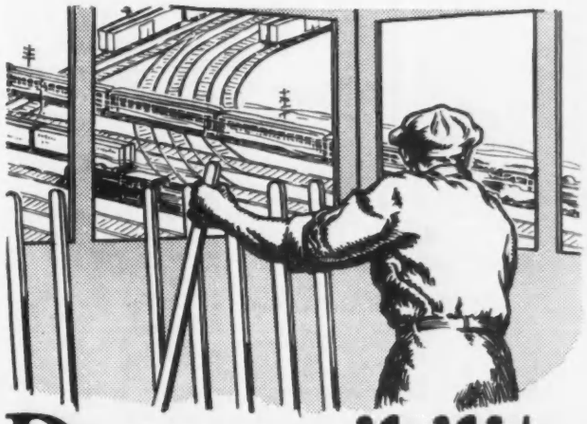
46 N. Green St.
Chicago, Ill.
Dept. Q

MAKE... Heating of Insulating Materials... TROUBLEPROOF

Insulating material—if poured while below the proper temperature point, fails to fill the crevices—leaves "air pockets." If poured at too high a temperature, paraffine or wax—insulation surrounding the coils, will be "fried out." In either case trouble is likely to result. The safest, and surest way to keep insulating material at proper pouring tmperatures is by STA-WARM ***automatically controlled electric heat.*** STA-WARM uses a regulating thermostat of patented design which keeps insulating materials always at the right pouring temperature. STA-WARM Heaters will fit your production operations. Write for details of types and sizes.

THE BECKWITH MACHINE CO.
402 Chestnut St. Ravenna, Ohio

Sta-Warm
AUTOMATIC ELECTRIC HEATERS



Responsibility

The west-bound freight weaves into a siding and slows down to a quiet stop. Just four minutes after it has cleared the main track the Mountain Limited crashes past. Tons of valuable freight are safe—and priceless human cargo is speeding onward.

Back of the sure movement of the train is quick, accurate judgment, and a switching mechanism that always works. At the *exact* time there is only one *right* lever to pull—only one chance to act. On these rest responsibility . . . . .

Leland recommendations are accurate and precise. A *certain* motor for a *certain* task is prescribed. It must function correctly—it has only one chance.

The manufacturers of Leland Motors feel this keen sense of Responsibility to their customers, and are also appreciative of the recommendations they make from time to time.

A.C. Repulsion Induction
D.C. Compound Wound
A.C. Polyphase
Interchangeability of Frames

The Leland Electric Co.
Dayton, Ohio, U.S.A.

Leland

Motors

STEEL SHEETS—Continued
Empire Steel Corp., Mansfield, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Manelec. See Empire Steel Corp.
Metelec. See Empire Steel Corp.
Newport Rolling Mill Co., Newport, Ky.
Polelec. See Empire Steel Corp.
Republic Iron & Steel Co., 335 Market, Youngstown, O
Tranelec. See Empire Steel Corp.
Unilov. See Universal Steel Co.
Universal Steel Co., Bridgeville, Pa.
Wheeling Steel Corp., Wheeling, W. Va

STEEL, STRIP. See Strip Steel.

STOCKS, Dies and Reamers
Hall-Will, Inc., Twelfth & Cranberry, Erie, Pa.
Red-E-Hall. See Hall-Will, Inc.
Toledo Pipe Threading Machine Co., 1445 Summit, Toledo, O

STONES, Commutator
Acme. See Green Equipment Corp.
Carc. See Electric Service Supplies Co.
Cleveland Stone Co., Union Trust Bldg., Cleveland, O.
Co-operative Utilities Co., 1503 Columbia Ave., Philadelphia, Pa.
Diamond Dee. See Co-operative Utilities Co.
Electric Service Supplies Co., 17th and Cambria, Philadelphia, Pa.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Lombard & Co., Somerville, Mass.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.

STOOLS, Factory; Steel
Angle Steel Stool Co., Plainwell, Mich.
Chicago Wire Chair Co., 613 N. La Salle, Chicago, Ill.
Royal Metal Mfg. Co., 1136 South Michigan Ave., Chicago.

STORAGE
Battery Plates. See Plates, Storage Battery.
Battery, Separators. See Separators.
Tools. See Tools, Storage Battery.

STRAINING MACHINES, INSULATION. See Wire Manufacturing Machines.

STRAIGHTENERS, Armature Shaft
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

STRANDING MACHINES. See Wire Manufacturing Machines.

STRIP STEEL
(Hot and Cold Roll).
Acme Steel Co., 2840 Archer Ave., Chicago, Ill. (Hot & Cold).
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. (Cold).
American Tube & Stamping Plant (Stanley Wks.) Bridgeport, Conn. (Hot & Cold.)
Athenia Steel Co., 135 William, New York, N. Y. (Cold.)
Barnes Co., Wallace, Bristol, Conn. (Hot.)
Central Alloy Steel Corp., Massillon, O. (Hot.)
Griffin Mfg. Co., Huron & Cherry, Erie, Pa. (Cold.)
Laclede Steel Co., 8th & Olive Sts., St. Louis, Mo. (Hot.)
Latrobe Electric Steel Co., Latrobe, Pa. (Hot & Cold.)
Republic Iron & Steel Co., 335 Market, Youngstown, O
Sharon Steel Hoop Co., Sharon, Pa. (Hot.)
Stanley Wks., New Britain, Conn. (Hot & Cold.)
Steel and Tubes, Inc., Cleveland, O. (Hot & Cold.)
Superior Steel Corp., Union Trust Bldg., Pittsburgh, Pa. (Hot & Cold.)
Thomas Steel Co., Warren, Ohio.
West Leechburg Steel Co., Farmers Bank Bldg., Pittsburgh, Pa. (Hot & Cold.)

STRIPPERS, Wire
Acme. See A. Laubscher.
Artos Engineering Co., 115 Brown, Milwaukee, Wis. (Cutting, Stripping and Measuring).
Austin Co., M. B., 108 S. Desplaines, Chicago, Ill.
Colonial-Premier Co., 229 W. Ohio, Chicago, Ill.
Dicke Tool Co., Downers Grove, Ill.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
E-Z. See Pyramid Products Co.
F. F. See France Mfg. Co.
France Mfg. Co., 10325 Berea Rd., Cleveland. (Motor Driven.)
Goehst. See Klein & Sons.
Hartman. See Service Sales & Mfg. Co.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill
Ives Mfg. Co., Meriden, Conn.
Klein & Sons, Mathias, Chicago, Ill.
Laubscher, A., 77 Fort Pleasant Ave., Springfield, Mass.
Perfection. See Weber Machine Corp.
Pyramid Products Co., 2311 S. State, Chicago, Ill.
Service Sales & Mfg. Co., 17005 Melgrave Ave., Cleveland Ohio.
Speedcraft. See Wire Stripper Co.
Thomas Steel Products Co., Warren, Ohio.
Weber Machine Corp., 33 S. Water, Rochester, N. Y.
Wire Stripper Co., 507 Erie Bldg., Cleveland, O.
Zierick Machine Wks., F. B., 6 Howard, New York City (Motor Driven Stripper & Twister).

SWITCHBOARD INSTRUMENTS. See Instruments, Portable and Switchboard.

SWITCHBOARD OPALS. See Lenses.

SWITCHBOARDS, SLABS AND BARRIERS
See Asbestos Slabs; Molded Insulation; Slate; Soapstone

SWITCH (Switches)
Arms. See Posts, Binding.
"Across the Line" Type. See Controllers, Motor.
Baby Knife. See Switches, Battery.
Battery. See Switches, Battery.
Canopy. See Switches, Snap.
Clock Operated. See Switches, Time.
Feed Through. See Switches, Snap.
Fixture. See Switches, Snap.
Float. See Switches, Tank.
Flush. See Switches, Snap.
Handles. See Handles, Wood
Knife, Baby. See Switches, Battery & Baby Knife.
Lever Radio. See Radio Mounting.
Lever. See Switches, Snap, Lever.
Limit. See Controllers, Motor.
Mercury. See Switches, Mercury
Motor Starting. Magnetic Type. See Controllers.
Motor Starting. Non-Magnetic. See Switches, Motor Starting.
Pendant. See Switches, Snap.
Pressure Regulating. See Controllers.
Push Button, Snap. See Switches, Snap.
Push Button, Motor Starting. See Switches, Remote Control
Radio Receiver. See Radio Mountings.
Range. See Switches Snap; Heavy Duty
Remote Control. See Switches, Remote Control.
Reversing. See Controllers.
Rotary. See Switches, Snap.
Safety. See Switches, Knife.
Snap. See Switches, Snap.
Starter Type. See Controllers.
Storage Battery. See Switches, Storage Battery.

Surface. See Switches, Snap.
Tank. See Switches, Tank.
Time. See Switches, Time.
Toggle. See Switches, Snap.
Tumbler. See Switches, Snap.

SWITCHES, Battery and Baby Knife
Cut-Out Switches.
Anti-Wood. See Keil & Son, Francis.
Bridgeport Switch Co., 209 Center, Bridgeport, Conn
Bryant Electric Co., Bridgeport, Conn.
Chapman. See Frank W. Morse & Co.
Chicago Elec. Mfg. Co., 2301 S. Halsted, Chicago, Ill.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Crown. See Edwards & Co., Inc.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Edwards & Co., Inc., 140th & Exterior, New York, N. Y.
Electrad, Inc., 428 Broadway, New York, N. Y.
Eureka. See Frank W. Morse & Co.
Fahnestock Elec. Co., cor. East Ave. and 8th, Long Island City, N. Y.
Handy. See Chicago Elec. Mfg. Co.
H. & H. See Hart & Hegeman Div.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co. Hartford, Conn. (Push Button.)
Harwood. See Frank W. Morse & Co.
Heinemann Elec. Co., Trenton, N. J.
Jost. See Frank W. Morse & Co.
Kappa. See Trumbull Elec. Mfg. Co.
Keil & Son, Francis, 401 E. 163rd, New York, N. Y.
Kendrick & Davis Co., Lebanon, N. H.
Keystone. See Frank W. Morse & Co.
King Mfg. Co., B. C., 302 Park Ave., Brooklyn, N. Y.
Knox Porcelain Corp., Knoxville, Tenn.
K-P-F Elec. Co., 855 Howard St., San Francisco, Cal.
Kurz & Root, Appleton, Wis.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Lyons Mfg. Co. (Mt. Carmel), New Haven, Conn.
Majestic Elec. Mfg. Co., 80 N. 12th St., St. Louis, Mo.
Manhattan Elecl. Supply Co., 510 Sixth Ave., New York.
Morse Co., Frank W., Boston, Mass.
Partrick & Wilkins Co., Philadelphia, Pa.
Porcelain Products, Inc., Findlay, Ohio.
Powerlite Switchboard Mfg. Co., 4149 E. 79th, Cleveland, O.
Pullrite. See Frank W. Morse & Co.
Reliable Electric Co., 3145 Carroll Ave., Chicago, Ill.
Samson Electric Co., Canton, Mass.
Spero Elec. Mfg. Co., E. 83rd and Woodland Ave., Cleveland
Sta-Rite. See Frank W. Morse & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Wood Elec. Co., C. D., 565 Broadway, New York, N. Y.

SWITCHES, Mercury
(For Temperature Control Apparatus.)
Con-Tac-Tor. See Time-O-Stat Controls Co.
Cooper Hewitt Electric Co., 410 Eighth Ave., Hoboken, N. J.
Cramblet Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Febrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
General Kontroler Co., 200 E. First, Dayton, O.
Kon-nec-tor. See Cooper Hewitt Elec. Co.
Kontax. See General Kontroler Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.
Time-O-Stat Controls Co., Elkhart, Ind.

SWITCHES, Motor Starting
Accessible. See Trumbull-Vanderpoel Elec. Mfg. Co
Aces. See Colt's Patent Fire Arms Mfg. Co.
Adam Elec. Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Barber Elec. Mfg. Co., North Attleboro, Mass.
Bull Dog Electric Products Co., Detroit, Mich.
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Metal Box Co., 236 E. 144th, New York, N. Y.
Crouse-Hinds Co., Syracuse, N. Y.
E. W. See Trumbull Elec. Mfg. Co.
F.A. See Adam Elec. Co., Frank.
F. A. Triumph. See Metropolitan Elec. Mfg. Co.
Federal Steel Products Co., 2 Ave. L., Newark, N. J.
Large-Dail Mfg. Co., 606 Cherry, Philadelphia, Pa.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O
Lundy Co., E. A., Fulton Bldg., Pittsburgh.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Major. See Adam Elec. Co., Frank.
Mamco. See Trumbull-Vanderpoel Elec. Mfg. Co.
Metropolitan Device Corp., 1250 Atlantic Ave., Brooklyn, N. Y.
Metropolitan Elec. Mfg. Co., Blvd. at 14th, Long Island City, N. Y.
Murray. See Metropolitan Device Corp.
Mutual. See Bull Dog Elec. Products Co.
Naro. See Metropolitan Elec. Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Nublade. See Colt's Patent Fire Arms Mfg. Co.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Robbins & Myers, Inc., Springfield, O.
Safe-Lock. See Trumbull-Vanderpoel Elec. Mfg. Co
Safelock. See Westinghouse Elec. & Mfg. Co.
Schmuckler & Sons, 2232 N. 28th, Philadelphia, Pa.
Square D Co., Detroit, Mich.
S. S. See Wadsworth Elec. Mfg. Co.
Tanner & Co., Wm. F., 511 Sharp, Baltimore, Md.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn
T. V. Safelock. See Trumbull-Vanderpoel Elec.
Unisafti. See Metropolitan Device Corp.
Unit-Versal. See Bull Dog Elec. Products Co.
Universal Metal Box & Products Co.
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Westinghouse Elec. & Mfg. Co., Mansfield, O.

SWITCHES, Remote Control
Push Button, Magnetically Operated.
Adam Electric Co., Frank, St. Louis, Mo.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Automatic Switch Co., 154 Grand, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Cutler-Hammer, Inc., 1287 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Dunco. See Struthers Dunn, Inc.
Electric Valve Mfg. Co., 68 Murray, New York, N. Y.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
H. P. See Palmer Elec. & Mfg. Co.
Industrial Controller Div. of Square D Co., Milwaukee, Wis.
Kato Engr. Co., Mankato, Minn.
Lincoln Elec. Co., Colt Rd. & Kirby Ave., Cleveland, O.
Major, F. A., System. See Adam Elec. Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md
Palmer Elec. & Mfg. Co., Waltham, Mass.
Precise Mfg. Co., 254 Mill, Rochester, N. Y.
Protectoswitch. See Precise Mfg. Co.

R. C. O. C. See South Bend Current Controller Co.
Sauter. See Cramer & Co., R. W.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
South Bend Current Controller Co., South Bend Ind.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Takamine Corp., 208 Rawson St., Long Island City, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore.
Triplock. See Monitor Controller Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

SWITCHES, Snap

	KEY
Feed Through	See p
Fixture (Canopy, Candelabra and Key Arm)	See F
Flush	See f
Lever, Toggle, Tumbler	See L
Pendant	See p
Push Button	See P
Rotary	See R
Surface	See s

See Also Switches, Snap; Heavy Duty.

Adam Electric Co., Frank, St. Louis, Mo.						
Anylite Elec. Co., Ft. Wayne, Ind.						L
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.	f	sp	P	R	L	F
Arrow Head. See Arrow Elec.						
Beaver Mfg. Co., 625 N. Third, Newark, N. J.	f	p	P			F
Best. See United States Elec. Mfg. Corp.						
Brascolite. See Guth & Co., Edwin.						
Bremer Elec. Mfg. Co., 139 N. 7th, Philadelphia, Pa.	f					
Bridgeport Switch Co., 209 Center, Bridgeport, Conn.						L F
Bryant Elec. Co., Bridgeport, Conn.	f	sp	P	R	L	F
B. S. Co. See Bridgeport Switch Co.						
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn.						F
Circle F. Mfg. Co., Trenton, N. J.	f		P		L	F
Circle T. See Trumbull Elec. Mfg. Co.						
Commercial. See Gaynor Electric Co.						
Connecticut Elec. Mfg. Co., Bridgeport, Conn.		p	P	R	L	F
Crouse-Hinds Co., Syracuse, N. Y.						L
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.			P			L
Diamond H. See Hart Mfg. Co.						
Dugle. See Bryant Elec. Co.						
Economy Fuse Mfg. Co., 2717 Greenview Ave., Chicago, Ill.						F
Gaynor Elec. Co., Bridgeport, Conn.						L
General Elec. Co., Merchandise Dept., Bridgeport, Conn.	f	sp	P	R	L	F
Glo-Guide. See Bryant Elec. Co.						
Gold Star Push Switch. See Hart & Hegeman.						
Guth & Co., Edwin, 2615 Washington Ave., St. Louis, Mo.						F
Hart Mfg. Co., Hartford, Conn.	f	sp	P	R	L	
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co. (Door Bolt Control)	f	sp	P	R	L	F
Hart. See Hart & Hegeman.						
H. & H. See Hart & Hegeman Mfg. Co.						
Hubbell, Inc., Harvey, Bridgeport, Conn.		sp			L	F
Jost. See Morse, Frank W.						
Keil & Son, Francis, 401 E. 163rd, New York, N. Y.	f		P			
Leviton Mfg. Co., 226 Newell, Brooklyn						F
Levolier. See McGill Mfg. Co.						
McGill Mfg. Co., Valparaiso, Ind.	f				L	F
Marks Products Co., 80 N. Ninth, Brooklyn, N. Y.					L	F
Metropolitan Elec. Mfg. Co., Blvd at 14th St., Long Island City, N. Y.		s		R		
Morse Co., Frank W., 291 Congress, Boston			P			
National. See Standard Elec. Mfg. Co.						
New England. See Paulding, John L.						
Nutmeg. See Hubbell, Harvey, Inc.						
Operite. See Morse Co., Frank W.						
Pass & Seymour, Solvay Sts., Syracuse, N. Y.	f	sp	P		L	F
Paulding, John I, New Bedford, Mass.	f	s	P			
Pen Tap. See Beaver Mfg. Co.						
Perkins. See Bryant Elec. Co.						
Pilot Radio & Tube Corp., 323 Berry, Brooklyn, N. Y.					L	
Pilotoggle. See Pilot Radio & Tube Corp.						
Pilotoggle. See Pilot Elec. Mfg. Co.						
Pullrite. See Morse, Frank W.						
Rodale Mfg. Co., 200 Hudson, New York	p					
Sears, Henry D., 80 Boylston, Boston	f	sp	P	R	L	F
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.			P			
Snapit. See Marks Products Co.						
Spartan. See Bryant Elec. Co.						
Standard Elec. Mfg. Co. 941 Wrightwood Ave., Chicago, Ill.	f	s	P	R	L	
Trigle. See Bryant Elec. Co.						
Trumbull Elec. Mfg. Co., Plainville, Conn.	f	s	P	R	L	
Tumboller. See Hart & Hegeman.						
Twi-Lite. See McGill Mfg. Co.						
United States Elec. Mfg. Corp., 222 W. 114th, New York, N. Y.	f					
Victor. See Keil & Son, Francis						
Washington. See Gaynor Electric Co.						
Weber. See Sears, Henry D.						
Workrite. See Morse, Frank W.						
Yankee. See Bryant Elec. Co.						

SWITCHES, Snap; Heavy Duty
Heavy duty rotary snap switches for Electric Range and Small Motor Control.
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn.
Diamond H. See Hart Mfg. Co.
Domestic Electric Co., 7723 St. Clair Ave., Cleveland, Ohio
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.

SWITCHES, Storage Battery; Automatic Disconnecting
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Penn Electric Switch Co., Des Moines, Ia.
Radioloc. See Cutler-Hammer Mfg. Co.

SWITCHES, Tank
Blackburn-Smith Corp., 25 W. 45th, New York, N. Y.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Electrical Repair Co., 240 W. 25th, New York, N. Y.
General Electric Co., Schenectady, N. Y.
Industrial Controller Div. of Square D Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Leader-Trahern Products Co., Decatur, Ill.
Ostrander Elec. Wks., W. R., 911 Atlantic Ave., Brooklyn.

SPECIAL PORCELAINS

THOMAS MADE porcelains not only promise but insure an unparalleled grade of insulation; *accuracy* that only skilled craftsmen accustomed to precision workmanship can produce; and *uniformity* that is the direct result of modern production facilities.

The Pioneer's experience befits him to offer the electrical manufacturer an exceptional service in the development of special porcelain parts of most any size or shape no matter how intricate.

Your Inquiries Invited

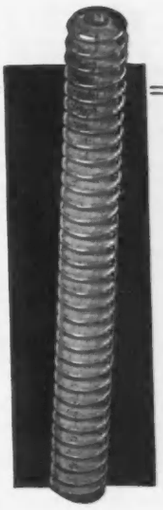
The R. Thomas & Sons Co.
LISBON, OHIO
U. S. A.

Established in 1873

NEW YORK BOSTON CHICAGO

Porcelava

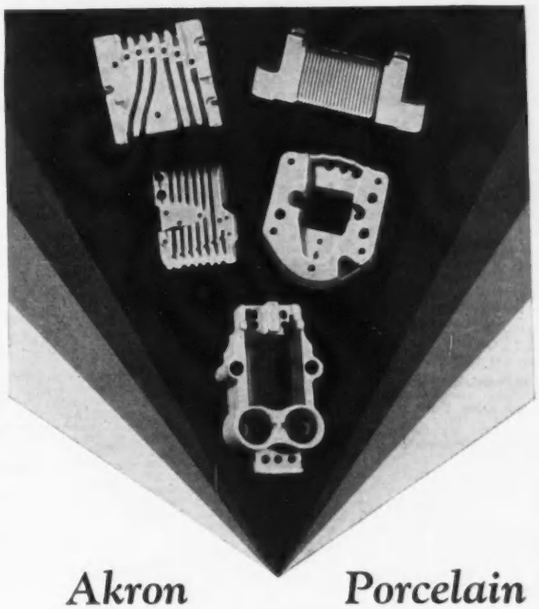
The best for Electric Heating Appliances



Our clay specialties, plain and threaded tubes, and Refractory Porcelain for Electric Heating Appliances are superior in every way; and "PORCELAVA" makes the best Pyrometer Insulation.

Burgess & Company
East Liverpool, Ohio
Factory at Wellsville, O

Chicago Representative:
F. D. FARNAM & CO.
559 No. Wells St., Chicago, Ill.



Akron Porcelain

Well formed - - - Strong
Accurate - - - Good appearance
Reasonable Prices

THE AKRON PORCELAIN CO.
Akron, Ohio
Formerly the Mogadore Insulator Company

Better commutators and other parts — at reasonable prices.

Make "EUREKA" your regular source of supply for commutators, and other parts such as—

Commutator Bars (forged, drawn or cast). Brush Holders. Copper Leaf and Gauze Brushes. Controller Fingers, Segments, Field Plates, etc. Switches. Non-ferrous Castings and Drop Forgings.

Dependable prompt deliveries of highest quality parts, at reasonable prices.

Let us figure with you on all or part of your requirements. Write us.

EUREKA METAL PRODUCTS CORP.
91 Clay Street, North East, Pa.

EUREKA

SWITCHES, Tank—Continued
Penn Elec. Switch Co., 20th & Walnut, Des Moines, Ia.
Sundh Elec. Co., Parkhurst St. at Ave. C, Newark, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, Time (Automatic Clock Operated Switches)

Anderson Mfg. Co., Albert & J. M., 119 A, Boston, Mass.
Astrachron. See Gem Engineering Co.
Automatic Elec. Heater Co., 1505 Race, Philadelphia, Pa.
Automatic Elec. Mfg. Co., Mankato, Minn.
Automatic Lighting Co., 831 Greenmount Ave., Baltimore.
Automatic Sprinkler Corp. of America, 910 B. of L. E. Bank Bldg., Cleveland, Ohio.
Automatic Timer Co., 1841 Euclid Ave., Cleveland, O.
Berry, A. Hall, 73 Murray, New York, N. Y.
Brown & Pengilly, Inc., 1264 Folsom, San Francisco, Cal.
Buckeye Time Switches, Inc., 1557 St. Clair Ave., Cleveland, O.
Cackle. See Berry A. Hall.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Clark. See Automatic Heater Co.
Con-tac-tor. See Absolute Con-tac-tor Corp.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Frisch, Walter P., 104 Linden, Rochester, N. Y.
Gem Engineering Co., Hempstead, N. Y.
General Electric Co., Schenectady, N. Y.
Go-N-Set. See G. & S. Research Lab.
G. & S. Research Laboratory, 1269 Cochran Ave., Los Angeles, Cal.
Hart Mfg. Co., Hartford, Conn.
Hartford. See Berry A. Hall.
Horni Signal Mfg. Co., 290 Hudson, New York, N. Y.
Jewel. See Time Switch Sales & Service.
Knowles, W. E., 2869 Broadway, Oakland, Cal.
Kwixset. See Thompson Clock Co.
Lamp-Lighter. See Robbins & Myers Co.
Liberty Bell Mfg. Co., Minerva, Ohio.
Mercury Time Switch Co., Marine City, Mich.
Northwestern Clock Co., Omaha, Neb.
Ohio Time Switch Co., 1439 St. Clair Ave., Cleveland.
Paragon Elec. Co., 409 S. Dearborn, Chicago, Ill.
Racine. See Reliance Automatic Ltg. Co.
Radio Owl, 2269 E. 51st, Los Angeles, Cal.
Radio Switchman. See R-V Mfg. Co.
Reliance Automatic Ltg. Co., 1925 Meade, Racine, Wis.
Research Mfg. Laboratory, 1269 Cochran Ave., Los Angeles.
Robbins & Myers Co., Springfield, O.
Russ Safety Switch Corp., 1 E. 42nd, New York, N. Y.
R-V Mfg. Co., Marshfield, Mass.
Sauter. See Cramer & Co.
States Co., Hartford, Conn.
Stromberg Electric Co., 223 W. Erie, Chicago, Ill.
Thompson Clock Co., H. C., Bristol, Conn.
Time Switch Sales & Service, 1841 Euclid Ave., Cleveland, O.
Tork Clocks, Inc., 12 E. 41st, New York, N. Y.
Walzer Automatic Timer Co., 342 Madison Ave., New York.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

TACHOMETERS

Speed Indicators, Speedometers, Revolution Counters.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Durant Mfg. Co., 655 Buffum, Milwaukee, Wis.
Electric Tachometer Corp., Spring Garden & Broad St., Philadelphia, Pa.
Holtzer-Cabot Elec. Co., Boston, Mass.
Leeds & Northrup Co., 4901 Stenten Ave., Philadelphia, Pa.
Productimeter. See Durant Mfg. Co.
Standco. See Sticht & Co.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Veeder Mfg. Co., 14 Sargeant, Hartford, Conn.
Weston Elecl. Instrument Co., 582 Frelinghuysen Ave., Newark, N. J.
Zernickow Co., O., 15 Park Row, New York, N. Y.

TAGS, Cable; Pole and Battery

American Radio Hardware Co., 135 Grand, New York, N. Y. (Battery Lead Tags.)
Benedict Mfg. Co., East Syracuse, N. Y.
Brooklin Underground Elec'l Mfg. Co., Glenside, Pa.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Grammes & Sons, Inc., L. F., Allentown, Pa.
International Tag Co., 319 N. Whipple, Chicago, Ill.
Matthews & Co., Jas. H., 3942 Forbes, Pittsburgh, Pa.
Premax Products, Inc., Niagara Falls, N. Y.
Viking Tool & Machine Co., 745 65th, Brooklyn, N. Y.
Waterbury Button & Moulding Co., Waterbury, Conn.

TAGS, Shipping

Campbell Paper Box Co., South Bend, Ind.
International Tag Co., 319 W. Whipple, Chicago, Ill.
TAMPING TOOLS, COIL. See Tools, Commutator Truing.
TANK SWITCHES. See Switches, Tank.
TANKS, TINNING. See Wire Manufacturing Machines.

TAPE, Asbestos

American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
General Asbestos & Rubber Co., Charleston, S. C.
Johns-Manville Corp., New York, N. Y.
Matthews & Co., Jas. H., 3942 Forbes, Pittsburgh, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Nicagrite. See Johns-Manville, Inc.
Shield Brand. See Mitchell-Rand Mfg. Co.

TAPE, Cotton, Linen, Silk; Tape, Sleeving, Webbing.

Alfalfa. See Burrell Belting Co.
Anchor Webbing Co., 300 Brook, Pawtucket, R. I. (Cotton, Silk).
Awabco. See Anchor Webbing Co.
Bermaline. See Burrell Belting Co.
Burrell Belting Co., 413 S. Hermitage Ave., Chicago, Ill.
Eagle. See Sidebotham, Inc., John.
General Electric Co., Schenectady, N. Y.
Gilmer Co., L. H., Cottman & Keystone Sts. (Tacony), Philadelphia, Pa.
Hope Webbing Co., 1005 Main, Providence, R. I.
Krout & Fite Mfg. Co., Allegheny Ave. & Emerald, Philadelphia, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sidebotham, Inc., John, 4317 Griscom, Philadelphia, Pa.
Smith Belting Co. (Germantown), Philadelphia, Pa.
Superfine. See Windsor Webbing Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Windsor Webbing Co., Pawtucket, R. I.
Worcester Braiding Co., 34 Southbridge, Worcester, Mass.

TAPE, Mica

Chicago Mica Co., 845 Campbell, Valparaiso, Ind.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Rubber and Friction

Ackerman. See Ackurate Rubber Co.
Ackurate Rubber Co., 25 Beaver St., New York, N. Y.
Adamson & Co., Joseph, Columbia and Germantown Aves., Philadelphia, Pa.
Adhere. See Westinghouse Elec. & Mfg. Co.
Alpha. See Johns-Manville, Inc.
Amazon. See Graybar Elec. Co.
Appleton Rubber Co., Franklin, Mass.
Black Diamond. See Dunton Co., M. W.
Boston Woven Hose & Rubber Co., Boston, Mass.
Brooklyn. See Johns-Manville, Inc.
Bull-Dog. See Boston Woven Hose & Rubber Co.
Candee. See Ackurate Rubber Co.
Canfield Rubber Co., Bridgeport, Conn.
Canton. See Plymouth Rubber Co.
Clifton. See Clifton Mfg. Co.
Clifton Mfg. Co., 65 Brookside Ave., Boston 30, Mass.
Competition. See New York Insulated Wire Co.
Double-Wear. See Dryden Rubber Co.
Dryden Rubber Co., 1014 S. Kildare Ave., Chicago, Ill.
Dundee, A. & B. See Okonite Co.
Dunton Co., M. W., 670 Eddy St., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Elkhart Rubber Wks., Elkhart, Ind.
Firestone Tire & Rubber Co., Akron, O.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y.
Grimshaw. See New York Insulated Wire Co.
Griptite. See Canfield Rubber Co.
Holfast Rubber Co., Atlanta, Ga.
Holditite. See United States Rubber Co.
Hydro-Proof. See Elkhart Rubber Wks.
Imperial Rubber Co., 220 Broadway, New York, N. Y.
Impervo. See Canfield Rubber Co.
Ireo. See Imperial Rubber Co.
Johns-Manville Corp., New York, N. Y.
Jomanco. See Johns-Manville, Inc.
Kerite Ins. Wire & Cable Co., 30 Church, New York, N. Y.
Manson. See Okonite Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New York Insulated Wire Co., 114 Liberty, New York, N. Y.
Okonite Co., Passaic, N. J.
O. K. See Appleton Rubber Co.
P. & B. See Ruberoid Co.
Paratex. See Appleton Rubber Co.
Paruco. See Passaic Rubber Co.
Passaic Rubber Co., Clifton, N. J.
Plymouth Rubber Co., 1400 Revere, Canton, Mass.
Red-X. St. Louis Rubber Cement Co.
Relio. See United States Rubber Co.
Ruberoid Co., 95 Madison Ave., New York, N. Y.
S. I. See Superior Insulating Tape Co.
Sitco. See Superior Insulation Tape Co.
Slipknot. See Plymouth Rubber Co.
Star. See Sullivan & Sons Mfg. Co., J.
Sticka. See Graybar Elec. Co.
Stixwell. See Clifton Mfg. Co.
Sullivan & Sons Mfg. Co., J., 2224 N. 9th, Philadelphia, Pa.
Superior Insulating Tape Co., 3044 Lambdin Ave., St. Louis.
2-Plex. See Holfast Rubber Co.
U. S. See United States Rubber Co.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Usco. See United States Rubber Co.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago.
Victor. See Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa

TAPE, Varnished Fabric

Acme Wire Co., New Haven, Conn.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New Jersey Wood Finishing Co., Woodbridge, N. J.
Radiotape. See Respro, Inc.
Respro, Inc., Wellington Ave. (Auburn), Providence, R. I.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sico. See Standard Insulator Co.
Standard Insulation Co., East Rutherford, N. J.
Voltape. See Respro, Inc.

TAPING MACHINES, Coil

Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Griswold Machine Co., George, New Haven, Conn.
Ridion Company, Frank, Boston, Mass.
Segur. See Electric Service Supplies Co.

TAPING MACHINES, Wire

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Wire Machinery Corp. of Am., New Haven, Conn.
TAPS. See Stocks, Dies and Reamers.
TENSION DEVICES, Coil Wire. See Racks, Wire Reel.

TENSION MACHINES, Band Wire

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.

TERMINALS AND CONNECTORS

Low Tension, Secondary Terminals and Connectors.
All-in-One. See Ohio Parts Co.
Barcy-Nicholson Co., 2801 Fort, W., Detroit, Mich.
Bassett Metal Goods Co., Derby, Conn. (General Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Burton-Rogers Co., Boston, Mass.
Cabelug. See Jones, Howard B.
Clark Metal Products, 490 Hancock Ave., Bridgeport.
Dixie Supply Co., 91 7th Ave., New York.
Double Grip. See Pons, Eugene
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electron. See Bassett Metal Goods Co.
Fahnestock Elec. Co., East Ave. and 8th, Long Island City, N. Y.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Ideal Clamp Mfg. Co., 198 Bradford, Brooklyn, N. Y.
Jones, Howard B., 2226 Wabansia, Chicago, Ill.
K. E. M. See Kulier Elec. Mfg. Co.
Kulier Elec. Mfg. Co. 575 Pierce Ave., Long Island City.
Morse Co., Frank W., Boston, Mass.
Nu-Way Snap. See Hatheway Mfg. Co.
Ohio Parts Co., 3391 Colerain Ave., Cincinnati, O.

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Our No. 1800 metal for temperatures up to 450° F.
Our No. 2800 metal for temperatures up to 1500° F.
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1600 Beard Avenue, Detroit, Mich.

Orum, S. R. M., 503 N. 11th, Philadelphia, Pa.
Patton-MacGuyer Co., Providence, R. I.
Pons, Eugene, 927 Campbell Ave., Schenectady, N. Y.
Petersen Co., 7 Beverly, Providence, R. I.
Rajah Co., Bloomfield, N. J.
Salem Elec'l Supply Co., Salem, Mass.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Shure. See Burton-Rogers Co.
Tinkerbox. See Weber Elec. Wks.
Waterbury Button & Moulding Co., Waterbury, Conn.
Weber Elec. Wks., Brooklyn Sta., Cleveland, O.
Wolverine Tube Co., 1415 Central Ave., Detroit, Mich.
Zierick Machine Wks., P. R., 6 Howard, New York.

TEST BENCHES, Armature

Allen Electric & Equipment Co., Kalamazoo, Michigan.
Burton & Rogers Co., Boston, Mass.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Hobart Bros. Co., Troy, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Pence & Son, H. O., San Luis Obispo, Cal.
Weidenhoff, Joseph, 4352 W. Roosevelt Road, Chicago, Ill.
TESTING INSTRUMENTS. See Instruments.

TESTERS, Coil

(Includes Armature Growlers, trouble shooters, and other portable testing devices). See also Instruments

Ace. See Weidenhoff, Joseph.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Ankenbrandt, J. J., 2140 Wakeman, Toledo, Ohio.
Armeter. See Chapman Electric Works, P. E.
Bartlett Electric Products Co., Goshen, Ind. (Storage Battery).
Batt-O-Meter. See Indiana Mfg. & Elec. Co., also Case Elec.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Case Elec. Co., Marion, Ind.
Century Electrical Co., 102 Randall Ave., Syracuse, N. Y.
Chapman Elec'l Works, P. E., 1820 Chouteau Ave., St. Louis, Mo
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Columbia. See Weidenhoff, Joseph.
Comparometer Co., New Ulm, Minn.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Economy. See Weidenhoff, Joseph.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Electrotest. See Comparometer Company.
Elmco. See Electric Machine Corp.
Ev-Ri-Test. See Weidenhoff, Joseph.
Ga-Jit. See General Instrument Corp.
General Instrument Corp., 225 Varick, New York, N. Y.
Herald Elec. Co., 35 East End Ave., New York, N. Y.
Hobart Bros. Co., Troy, Ohio.
Ideal. See Ankenbrandt, J. J.
Indiana Mfg. & Electric Co., Marion, Indiana.
Klatzman Electrical Mfg. Co., 234 N. Central, Gilman, Ill.
Leich Electric Co., Genoa, Ill.
Lundin Electric Machine Co., 10 Thacher, Boston, Mass.
Mallory Electric Co., Factories Bldg., Toledo, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Paneltest. See Allen Elec. & Equip. Co.
Portometer. See Allen Elec. & Equip. Co.
Portostat. See Allen Elec. & Equip. Co.
Presto. See Metal Specialties Mfg. Co.
Reliable Parts Mfg. Co. Wellington, Ohio.
Rex Batrystat. See Bartlett Products Co.
Scout. See Leich Electric Company.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago, Ill.
Test-All. See Colpin Corp.
Test-O-Meter. See Weidenhoff, Joseph.
Test-Rite. See Colpin Corp.
Victory. See Weidenhoff, Joseph.
Weidenhoff, Joseph. 4352 W. Roosevelt Rd., Chicago, Ill.

TESTING LABORATORIES

Baker & Co., Inc., 54 Austin, Newark, N. J.
Elec'l Testing Laboratories, 80th St. and East End Ave., New York, N. Y.
National Elec'l Inst. Co., 162 Sidney, Cambridge, Mass.
New York Testing Laboratories, 80 Washington, New York.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
THERMO JUNCTIONS. See Instruments, Laboratory Standard.

THERMOSTATIC METAL

Baker & Co., Inc., 54 Austin, Newark, N. J.
Chace Valve Co., W. M., 1600 Beard Ave., Detroit, Mich.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I.
Improved Seamless Wire Co., 775 Eddy, Providence, R. I.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Venbur. See Coffin Mfg. Co., B. F.
Wilco. See H. A. Wilson Co
Wilson Co., H. A., Newark, N. J.

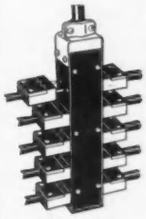
THERMOSTATS

American Thermostat Co., 326 Jeliff Ave., Newark, N. J.
Automatic Appliance Co., Jackson, Mich.
Bak-Rite. See Electric Appliance Mfg. Co.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia, Pa.
Burke Controller Co., 349 Lexington Ave., New York, N. Y.
Cobb Elec. Appliance Co., 100 Massachusetts Ave., Boston,
Cramblett Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Diamond H. See Hart Mfg. Co.
Electric Automatic Appliance Co., Denver, Colo.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electric Maid. See Hankscraft Co.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Freas Thermo-Electric Co., 1206 S. Grove, Irvington, N. J.
Globe Mfg. Co., Battle Creek, Mich.
Hankscraft Co., 615 E. Washington, Madison, Wis.
Hart Mfg. Co., Hartford, Conn.
Hi-Lo. See Boston Machine Wks. Co.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Interstate Products Corp., 29 Commercial, Newark, N. J.
King. See Electric Heat Control Co.
Klixon. Set Westinghouse Electric & Mfg. Co.
Manhattan Elecl. Supply Co., 510 Sixth Ave., New York.
Marvel. See American Thermostat Co.
Mercoid Corp., 544 W. Adams, Chicago, Ill.
Moeller, A. E., 261 Sumpter, Brooklyn, N. Y.
Midget. See Coffin Mfg. Co., B. F.
National Steel Construction Co., 425 Fountenac, Seattle, Wash.
Pyratherm. See Federal Gauge Co.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.

CONNECTORS
for ELECTRICAL DEVICES

No. 950

No. 990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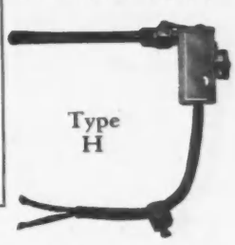

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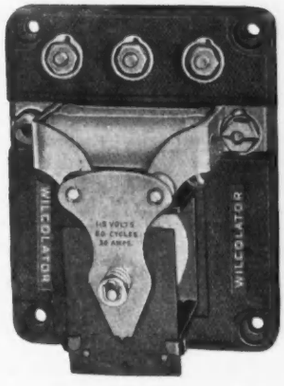

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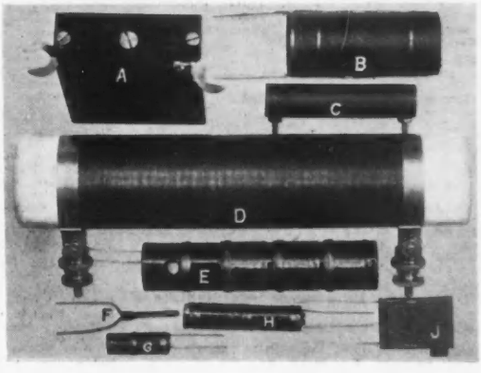

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Teeple Co., L. R., 540 E. 9th, Portland, Ore.
Thermolectric. See Bishop & Babcock Sales Co.
Thermomap. See Spencer Thermostat Co.
Time-O-Stat Controls Co., Elkhart, Ind.
Trent Co., Harold E., 429 N. 12th, Philadelphia, Pa.
Visaflame. See Mercoid Corp.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilcolator Co., Newark, N. J.

TIGHTENERS, Commutator

Elmes Engineering Works, Chas. F., 230 N. Morgan, Chicago, Ill.
TIME SWITCHES. See Switches, Time.
TINNING TANKS, WIRE. See Wire Manufacturing Machines.
TINSEL. See Wire, Insulated.

TINSEL, Cord and Thread

Belden Mfg. Co., 2310 B S. Western Ave., Chicago, Ill.
Diamond Braiding Mills, Chicago Heights, Chicago, Ill.
Frank & Co., M. J., 15 W. 39th St., New York, N. Y.
Hy-Sil Mfg. Co., Revere, Mass.
Kilo Co., 2 E. 23rd, New York, N. Y.
Koelle, Frederick C., Real Estate Trust Bldg., Philadelphia.
Lees Mfg. Co., 320 Broadway, New York, N. Y.
Montgomery Co., J. R., Windsor Locks, Conn.
Rockbestos Products Corp., Nicoll & Canner, New Haven, Ct.
Springfield Wire & Tinsel Co., Springfield, Mass.
Taft Co., R. C., 174 N. Franklin, Chicago, Ill.

TIPS, Cord

Duro. See McEvoy, C. H.
McEvoy, C. H., 430 Broadway, Lowell, Mass.
National Acme Mfg. Co., 7500 Stanton Ave., Cleveland, O.
Norden & Co., S. 180 S. Water, Providence, R. I.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y.
Waterbury Brass Goods Corp., Waterbury, Conn.
TOOLS, Commutator Slotting. See Slotting Machines & Tools, Commutator.

TOOLS, Coil Tamping

Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.

TOOLS, Commutator Truing

Acme. See Green Equipment Corp.
Allen Elec. & Equipment Co., N. Pitcher St., Kalamazoo, Mich.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Central Mfg. Co., Fairfield, Ia.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Jordan Bros., 74 Beekman, New York, N. Y.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, Ohio.

TOOLS, Storage Battery

Battery Euipment & Supply Co., 7530 Greenwood Ave., Chicago, Ill. **Burning Racks, Battery Trucks, Plate Pressers, Mallets, Lead Burners and Strainers.**
Battery Parts Co., Inc., Wilkinsburg, Pa. (Leads.)
Battery Tools Co., 29 Willow, Montclair, N. J.
Besco. See Battery Equipment & Supply Co.
Bobbett Elec. Mfg. Co., 811 E. 43rd St., Chicago, Ill. (Knife Heaters.)
Canedy-Otto Mfg. Co., 1816 McGee, Chicago Heights, Ill. (Floor Vises.)
General Elec. Co., Schenectady, N. Y. (Lead Burning Outfits.)
Heet-A-Knife. See Op-al. Elec. & Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati. (Terminals.)
Op-al Elec. & Mfg. Co., 1057 E. 30th St., Indianapolis, Ind. (Knife Heaters.)
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa. (Pillar Post Sleeves, Tongs, Reamers, Strap Punches, Terminal Pullers, Steamers, Racks or Stands, Terminal Post Shapers, Battery Analyzer, Post Sealing Machine, Plate Burning Press, Press and Stands.)
Pyratip. See General Elec. Co.
Reliable Parts Mfg. Co., Wellington, O. (Steamer and Still, Filler, Separator Cutter, Clips, Carrier, Post Cutter, Terminal and Cell Puller.)
Thompson Mfg. Co., Meadville, Pa. (Reamers, Terminal Post Pullers, Pressing Tongs.)

TORCHES AND FURNACES

Acetylene, Alcohol, Gasoline, Kerosene.
Bernz Co., Otto, Newark, N. J.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dreadnaught. See Wall Mfg. Supply Co.
Jim Dandy. See Lasher-Weeber Co.
Klein & Sons, Mathias, Chicago, Ill.
Lasher-Weeber Co., 261 Franklin, Boston, Mass.
McGill Mfg. Co., Valparaiso, Ind.
Peerless. See Lasher-Weeber Co.
Staysalite. See Klein & Sons, Mathias.
TORPEDO Cord. See Twine.
TORSION BALANCES. See Instruments, Laboratory Standard

TRANSFORMERS

Radio. See Radio Circuit Components.
Gas Tube Sign. See Transformers, Oil Burner.
Oil Burner Ignition. See Transformers, Low & Intermediate Voltage.

TRANSFORMERS, Low and Intermediate Voltage

For Oil Burners, Gas Tube Signs, and other special purpose.
American Bosch Magneto Corp., Springfield, Mass.
American Transformer Co., Newark, N. J.
Campbell Elec. Mfg. Co., Lynn, Mass.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago,
Dongan Elec. Mfg. Co., 2335 Franklin, Detroit, Mich.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
K-W Ignition Corp., 2811 Chester Ave., Cleveland, Ohio.
Manhattan Elect. Supply Co., 510 Sixth Ave., New York.
Sorgel Electric Co., 99 W. Water, Milwaukee, Wis.
Standard Transformer Co., Warren, O.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago, Ill.
Uptigraff Mfg. Co., R. E., First National Bank Bldg., Pittsburgh, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Webster Electric Co., Racine, Wis.
TRANSMISSION DRIVES. See Chain, Transmission.

TRANSMITTERS, Power

Controller drive giving a variety of speeds for use in connection with coil taping machines.
Electric Service Supplies Co., 17th & Cambria Sts. Philadelphia, Pa.
Segur. See Electric Service Supplies Co.
TROUBLE FINDERS. See Instruments, Portable and Switchboard; also Testers, Coil.
TRUCKS, Armature. See Lifts, Armature.

TRUCKS, Factory Steel

Angle Steel Stool Co., Plainwell, Mich.
TRUING Devices, Commutator. See Tools, Commutator.
TUBE (Tubes) (Tubing) Adapters. See Radio Receiver Parts.
Brass. See Tubing, Brass.
Condenser. See Tubing, Brass and Copper.

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Copper. See Tubing, Brass.
Cutters. See Stocks, Dies, etc.
Fibre. See Fibre.
Fibre Candle. See Candles.
Mica. See Mica.
Paper. See Tubes, Paper.
Platinum. See Platinum.
Pyrometer. See Cores, Resistance.
Refractory. See Cores, Resistance.
Radio. See Radio Vacuum Tubes.
Varnished Fabric. See Tubing, Varnished Fabric.

TUBES, Paper; Cores; Sleeves, Bushings

Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Climax Tube Co., Mystic, Conn.
Klimaxcore. See Climax Tube Co.
McCausland, J. E., 86 Valley, Providence, R. I.
Fairpoint Corp., New Bedford, Mass.
Reliable Elec. Co., 3145 Carroll Ave., Chicago, Ill.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa.
Stone Paper Tube Co., 38 O. N. E., Washington, D. C.
Textile Tube Co., Fall River, Mass. (Paper Sleeves.)

TUBING, Brass and Copper

American Brass Co., Waterbury, Conn.
Anaconda. See American Brass Co.
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
Bull Dog. See National Elec. Products Corp.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., T. E., 54 Lafayette, New York
Cook, Dunbar Smith Co., 85 Sprague, Providence, R. I.
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
French Mfg. Co., 128 Robbins, Waterbury, Conn.
Michigan Copper & Brass Co., 5851 W. Jefferson Ave., Detroit, Mich.
Mueller Brass Co., Port Huron, Mich.
National Copper & Smelting Co., 1395 Coltman Rd., Cleveland, O.
National Elec. Products Corp., Pittsburgh, Pa.
Randolph Clowes Co., Waterbury, Conn.
Relleum. See Mueller Brass Co.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Rome Brass & Copper Co., Rome, N. Y.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Rome Turney Radiator Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa.
Summerill Tubing Co., Bridgeport, Pa.
Torrington Mfg. Co., Torrington, Conn.
United Wire & Supply Co., 1497 Elmwood Ave., Providence.
Wells Co., A. H., Watertown Ave., Waterbury, Conn.
Wolverine Tube Co., 1415 Central Ave., Detroit, Mich.

TUBING, Flexible Metallic

(Flexible Tubing.)
Almond Mfg. Co., T. R., Ashburnham, Mass.
American Metal Hose Co., Waterbury, Conn.
American Metal Moulding Co., 146 Coit St., Irvington, N. J.
Anaconda Wire & Cable Co., 25 Broadway, New York, N. Y.
Auto-Brassflex. See National Metal Elec. Products Corp.
Auto-Steelflex. See National Metal Elec. Products Corp.
Breeze Corp., Inc., 24 S. 6th, Newark, N. J.
Fischer Spring Co., Chas., 738 Kent Ave., Brooklyn, N. Y.
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa.
Riflex. See United Metal Hose Co.
Sleeper & Hartley, Inc., Worcester, Mass.
Time-O-Stat Controls Co., Elkhart, Ind.
Titeflex Metal Hose Co., Newark, N. J.
Triangle Conduit Co., Dry Harbor Rd. and Cooper Ave., Brooklyn, N. Y.
United Metal Hose Co., 724 Garrison Ave., New York, N. Y.
White Dental Mfg. Co., S. S., 152 W. 42nd, New York.

TUBING, Rubber

Rubber Tubing for Insulating Wire in Instruments and Telegraph Signal Lines.
Canfield Rubber Co., 702 Railroad Ave., Bridgeport, Conn.
Eisler Electric Corp., 756 S. 13th, Newark, N. J.
Faultless Rubber Co., Ashland, O.
Forest City Rubber Co., 1276 Ontario, Cleveland, O.
Goodrich Rubber Co., B. F., Akron, O.
Rubber-Vac. See Eisler Electric Corp.
Tyler Rubber Co., Andover, Mass.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.

TUBING, Varnished Fabric

Insulating Tubing—Spaghetti.
Acme Wire Co., New Haven, Conn.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y
Bentley-Harris Mfg. Co., Conshohocken, Pa.
Brand & Co., William, 268 Fourth Ave., New York, N. Y.
Empire. See Mica Insulator Co.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Insulated Duct & Cable Co., Stokes, Trenton, N. J.
Insuline Corp. of America, 76 Cortlandt, New York, N. Y
Irvington Varnish & Insulator Co., Irvington, N. J.
Lee Tire & Rubber Co., Conshohocken, Pa.
Mica Insulator Co., 200 Varick, New York, N. Y.

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Pearce Co., R. T., Covington, Ky. (Insulated Waxed Cotton.)
Turbo. See Brand & Co.
Varflex Corp., Rome, N. Y.
TURNED-UP BOXES AND CABINETS. See Cabinets, Sheet Steel.
TURNING TOOLS, COMMUTATOR. See Tools, Commutator Truing.

TWINE, Armature Winding; Torpedo Cord

Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Wirne & Son, Frank W., 42 N. Front, Philadelphia, Pa.
UNDERCUTTERS, Mica. See Slotting Machines & Tools, Commutator.
UNITS, Refrigerator Condenser. See Condenser Units, Refrigerator.

UNITS, Rods and Grids, Resistance

Acme Elec. Heating Co., Dept. R, 1217 Washington, Boston.
Allen-Bradley Co., 484 Reed, Milwaukee, Wis.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa.
Bradleyunit. See Allen Bradley Co.
Buffalo Products Co., Broome & Lafayette Sts., New York.
Burger, J. P., 1813 Columbus Rd., Cleveland, O.
Calrod. See Edison Elec. Appliance Co.
Chromalox. See Edwin L. Wiegand Co.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Crown Coloring & Chemical Co., 23 W. 17th, New York.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Dalton Elec. Heating Co., 287 Bridge St., Salem, Mass.
Dalton-Marsh Co., 88 Holten, Danvers, Mass.
Daric Co., 35 E. 21st, New York, N. Y.
Di-El-Ite. See Wirt Co.
Dixon Crucible Co., Jos., Jersey City, N. J.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Edgerest. See Industrial Controller Div.
Edgewound. See Monitor Controller Co.
Edison Electric Appliance Co., 5600 W. Taylor, Chicago, Ill.
Elec. Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electro Thermal-Unit Co., 44 N. Fourth, Philadelphia, Pa.
Elemite. See Louthan Mfg. Co.
Fits-All. See Eagle Elec. Mfg. Co.
Fitz-All. See Rodale Mfg. Co.
Fitz-Rite. See Rodale Mfg. Co.
Fix-All. See Willow Elec. Mfg. Co.
F & M. See Hiram Marks Elec. Co.
General Electric Co., Schenectady, N. Y.
Globar Corp., Niagara Falls, N. Y.
Glo-Well. See Eagle Elec. Mfg. Co.
Gold Seal Elecl. Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
Hance-Parker Mfg. Co., Meriden, Conn.
Hankscraft Co., 615 E. Washington, Madison, Wis. (Oven Heater Unit.)
Hardwick, Hindle, Inc., 122 Greenwich, New York, N. Y.
Hexwound. See Monitor Controller Co.
Industrial Controller Div. of Square D Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Industrial Heater Co., 300 Canal, New York, N. Y.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa. (Radio Resistance.)
Kricheles Mfg. Co., 255 Calyer, Brooklyn.
Louthan Mfg. Co., East Liverpool, O.
Marks, Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.
Monitor Edgewound. See Clark Controller Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Nelco. See Nelson Electric Co.
Nelson Electric Co., Plant City, Fla.
Northern Electric Co., 2833 N. Western Ave., Chicago, Ill.
Ogden Mfg. Co., 3947 Armitage Ave., Chicago, Ill.
Ohmite Mfg. Co., 636 N. Albany Ave., Chicago, Ill.
Ohm-Spun. See States Co.
Op-al Elec. & Mfg. Co., 1057 W. 30th, Indianapolis, Ind.
Parker & Co., J. C., 407 Bulletin Bldg., Philadelphia, Pa.
Poloron Elec. Mfg. Co., 20 Bond, New York, N. Y.
Presto Products Co., 64 University Place, New York, N. Y.
Prometheus Elec. Corp., 338 W. 13th, New York, N. Y.
Pyrex. See Westinghouse Elec. & Mfg. Co.
Reben Elec. Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Renuall. See Ogden Mfg. Co.
Repairall. See Waage Elec. Co.
Replaceall. See Waage Elec. Co.
Ribohm. See Ward Leonard Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Rubicon Co., 29 N. 52th, Philadelphia, Pa.
Security Elec. Mfg. Co., 2635 Canton St., Chicago, Ill.
Seeco. See Automatic Electric Heater Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Smoothwound. See Monitor Controller Co.
Snoco. See Snow & Co.
Snow & Co., E. W., Rochester, N. Y.
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.
Super. See Northern Elec. Co.
United Metal Art Mfg. Co., 293 Wyckoff Ave., Brooklyn, N.Y.
Vitrohm. See Ward Leonard Elec. Co.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago
Ward Leonard Elec. Co., 31 South, Mt. Vernon, N. Y.
Warren Elec. Appliance Co., Warren, Pa.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegand Co., Edwin L., 421 First Ave., Pittsburgh, Pa.
Wirt 5421 Greene. Philadelphia, Pa.
VACUUM CLEANER BAGS. See Bags, Vacuum Cleaner.
VACUUM DRYING & IMPREGNATING OVENS. See Ovens, Industrial.
VACUUM PUMPS. See Pumps, Vacuum.

VALVES, Electrically Operated

Asco. See Automatic Switch Co.
Automatic Switch Co., 154 Grand, New York.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Crane Co., 836 Michigan Ave., S., Chicago, Ill.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Electric-Valve Mfg. Co., 68 Murray, New York, N. Y.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Gas-Gard Co., 375 Main St., E., Rochester, N. Y. (Gas.)
General Electric Co., Schenectady, N. Y.
Golden-Anderson Valve Specialty Co., 1305 Fulton Bldg., Pittsburgh, Pa.
Lunkenheimer Co., Cincinnati, O.
Minneapolis-Honeywell Regulator Co., Fourth Ave. & 28th, Minneapolis, Minn.
Nacco Mfg. Co., 1482 Clara Ave., St. Louis, Mo.
Northside Elec. Co., 4227 Spring Grove Ave., Cincinnati, O.
Reading Steel Casting Co., Bridgeport, Conn.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
St. Louis Motor Valve Co., St. Louis, Mo.
Tagliabue Mfg. Co., C. J., 18-33rd St., Brooklyn, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore. (Gas.)
Time-O-Stat Controls Co., Elkhart, Ind.
Victor. See Lunkenheimer Co.
Zeco. See Zisch Engineering Corp.
Zisch Engineering Corp., 39 Avenue L, Newark, N. J. (Gas.)
VARNISH. See Paint, Varnish, Lacquer.
VARNISHED TAPE. See Tape, Varnished Fabric.
VARNISHED TUBING. See Tubing, Varnished Fabric.
VOLT BOXES. See Instruments, Laboratory Standard.
VOLTMETERS. See Instruments.
VULCANITE. See Rubber, Hard.

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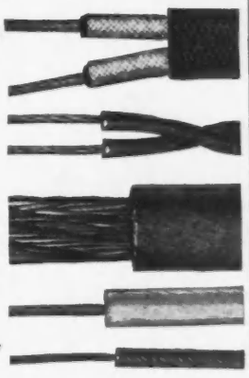

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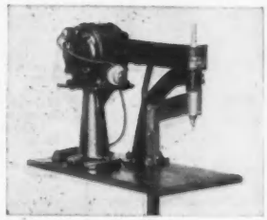

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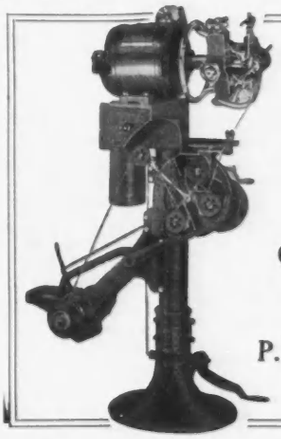

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Chase Brass & Copper Co., Waterbury, Conn.
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Hubbard Spring Co., M. D., Pontiac, Mich.
Massachusetts Machine Shop, Inc., Boston, Mass.
New England Screw Co., Dept. A., 44 Farnsworth, Boston.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Wrought Washer Mfg. Co., 46 S. Bay, Milwaukee, Wis.

WATTMETERS. See Instruments.

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Junction Box, Potheads, Battery Tops, Bolt Head Holes.
Wax and Compound.....See S
Saturating and Finishing, Braided Wire, Impregnating Fabric and Paper.
Chatterton's Compound.....See C

Ackurate Rubber Co., 25 Beaver, New York, N. Y. W . . . .
Ajax. See Sherwin-Williams Co.
Asphalt Products Co., 6531 S. State, Chicago. . . S . .
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. C
Biwax Corp., 208 S. La Salle, Chicago, Ill. . . . W S . .
Black Nego. See Williams Co., F. M.
Bulls-Eye. See Zinsser & Co.
Candy & Co., 35th and Maplewood Ave., Chicago W S . .
Clifton Mfg. Co., 65 Brookside Ave., Boston. C
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. . . . . W S . .
Dolph Co., John C., 168 Emmet, Newark, N. J. W . . . .
Di Electric Puttie. See Ackurate Rubber Co.
Ever-Protect. See National Cable Compound Co.
Flake White. See Williams Co., F. M.
General Electric Co., Merchandise Dept., Bridgeport, Conn. . . . . W . . .
Geoge Co., P. A., 4153 Bingham Ave., St. Louis. W . . .
Globe Chemical Co., Murray Road & Big 4 R. R. St. Bernard, Cincinnati, O. . . . . W S . .
Goldo Brown. See Williams Co., F. M.
Great Lakes Thread & Yarn Co., Div. of General Cable Corp., 5133 Wesson Ave., Detroit, Mich. . . . . W . . .
Hercules Powder Co., 975 Market, Wilmington, Del. (Wood Rosin) . . . . . S . .
Hexsulate. See Tar Products Corp.
Imco. See Great Lakes Thread & Yarn Co.
India Red Seal. See Williams Co., F. M.
Insulatine Co., 1 Broadway, New York. . . . . W . . .
Knox & Morse Co., 80 Freeport, Boston, Mass. . . . . W S . .
Leverite. See Mitchell-Rand Mfg. Co.
Lime Seal. See Mitchell-Rand Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind. C
Mineralac Elec. Co., 1045 Washington Blvd., Chicago, Ill. . . . . W . . .
Mitchell-Rand Mfg. Co., 19 Vesey, New York. . . . W S C
Mule-Hide. See Lehon Co.
National Cable Compound Co., Mitchell, Ind. . . . W . . .
National Wax Co., 189 W. Madison, Chicago, Ill. . . S . .
Nu-Blac. See Star Porcelain Co.
Par Flexo. See Williams Co., F. M.
Rubberseal. See Mitchell-Rand Mfg. Co.
Rub-Flexo. See Williams Co., F. M.
Seldner & Enequist, Inc., 85 Hausman, Brooklyn, N. Y. . . . . W . . .
Sherwin-Williams Co., Cleveland, O. . . . . W . . C
Standard Varnish Wks., 433 4th Av., New York. . W . . .
Standard Wax & Import Co., 110 E. 42nd, New York, N. Y. . . . . W S . .
Star Porcelain Co., Trenton, N. J. . . . . W . . C
Tacrite. See Seldner & Enequist, Inc.
Tar Products Corp., Providence, R. I.
Trotter & Co., E. T., 576 Johnson Ave., Brooklyn, N. Y. . . . . W S . .
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Williams Co., F. M., 1288 Prospect Ave., Brooklyn, N. Y.
Zinsser & Co., 48 Vesey, New York, N. Y. . . . . W . . .

WEDGE DRIVERS. See Tools, Cummutator.

WELDS, Lamp Lead-in. See Filaments, Incandescent

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A. E. F. See American Electric Fusion Corp.
Agnew Electric Welder Co., Milford, Mich.
Allan Mfg. & Welding Co., Inc., 725 Washington, Buffalo
Almanc. See Allan Mfg. & Welding Co., Inc.
Alternarc. See Electric Arc Cutting & Welding Co.
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Ames Co., 115 Ninth, Brooklyn, N. Y.
Burke Electric Co., Erie, Pa.
Cushing Mfg. Co., 5617 Pacific Blvd., Los Angeles, Cal.
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Electric Welding Machine Co., 1530 Larned, E., Detroit.
Farwest Electric Welder Co., 1107 Northlake Ave., Seattle.
Federal Machine & Welder Co., Dana Ave., Warren, O.
Fleet-Weld. See Lincoln Elec. Co.
Fusion Welding Corp., 10257 Torrence Ave., Chicago.
General Electric Co., Schenectady, N. Y.
General Engrg. & Supply Co., 160 5th Ave., New York, N. Y.
Gibb Welding Machines Co., Bay City, Mich.
Hansen. See Northwestern Mfg. Co.
Hollup Corp., C. H., 3333 W. 48th Place, Chicago, Ill.
Lincoln Electric Co., Coit Rd. and Kirby Ave., Cleveland.
McAdams Co., J. C., New Britain, Conn.
Nigg Engineering Corp., Second St. & Covina Blvd., Covina, Cal.
Northwestern Mfg. Co., 480 Clinton, Milwaukee, Wis.
Owen Elec. Mfg. Co., Fayetteville, N. C.
Plastic Arc. See Wilson Welder & Metal Co.
Pyrotip. See General Elec. Co.
Quasi-Arc., Inc., 11 W. 42nd St., New York, N. Y.
Ryerson & Son, Jos. T., 2558 W. 16th, Chicago, Ill.
Sellars Arc Welder Co., 1200 Fourth Ave., Seattle, Wash.
Seneca Electric Welder Corp., 5857 Woodward, Detroit, Mich.
Siemund Wenzel Electric Welding Co., 79 Hancock, Long Island City, N. Y.
Swift Elec. Welder Co., 2567 W. Grand Blvd., Detroit,
Taylor-Winfield Corp., Mahoning Ave., Warren, O.
Thompson Electric Welding Co., Lynn, Mass.
Una Welding & Bonding Co., 1615 Collamer Ave., Cleveland, O.
U. S. L. Battery Corp., Niagara Falls, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metal Co., Hoboken factory, Terminal Bldg., Hoboken, N. J.
Zeus. See Gibb Welding Machine Co.

WHEATSTONE BRIDGES. See Instruments, Laboratory Standard.

WICKS, Lubricating

Brawley, T. R., 279 20th, Brooklyn, N. Y.

WINDERS

Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Coil. See Winding Machines, Armature & Field Coil.
Electromagnet. See Winding Machines, Induction Coil.
Filament. See Machines, Lamp Making.
Induction Coil. See Winding Machines, Induction Coil.
Loop. See Winding Machines, Armature & Field Coil.

WINDING MACHINES, Armature and Field Coil

Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Conran, Frederick M., 107 Colden, Newark, N. J.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Handy. See Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Herald Electric Co., 35 East End Ave., New York, N. Y.
Hunsdorf, Wm., 2056 E. Fourth, Cleveland, O.
Liberty Starter Co., 271 Vinewood Ave., Detroit, Mich.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Mutual Foundry & Machine Co., Atlanta, Ga.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ridlon Co., Frank, 253 A St., Boston, Mass.
Segur. See Electric Service Supplies Co.
Superior. See Armature Coil Equipment Co.

WINDING MACHINES, Induction Coil

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Conran, Frederick M., 107 Colden, Newark, N. J.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Leesona. See Universal Winding Co.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Morris Register Co., 29th & Broadway, Council Bluffs, Iowa.
Radio Production Machinery Co., 212 Centre, New York.
Universal Winding Co., Boston, Mass.
Viking Tool & Machine Co., 747 65th, Brooklyn, N. Y.
Weehawken Engineering Co., 543 Gregory Ave., Weehawken, N. J.

WINDINGS. See Coils, Finished.

WINDOW SHADES, Factory

Athey Co., 6142 West 65th St., Chicago, Ill.

WIRE (Cable) (Cord). Aluminum. See Aluminum

Copper Clad. See Wire, Copper Clad.
Forms. See Forms, Wire.
Frames. See Forms, Wire.
Fuse. See Fuses and Fuse Wire
Lamp & Tube Filament. See Filaments, Incandescent Lamp.
Molybdenum. See Molybdenum.
Phosphor Bronze. See Phosphor Bronze.
Platinum. See Platinum.
Radio Bus. See Wire, Bare.
Scrapers. See Strippers.

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Strippers. See Strippers.
Tungsten. See Filament, Incandescent Lamp.

WIRE, Bare

Armature Banding.....See S
Copper Wire.....See C
Iron Wire.....See S
Phosphor Bronze.....See B
Radio Bus Wire.....See C
Resistance Wire.....See R
Steel Wire.....See S

Acme. See Alloy Metal Wire Co.
Advance. See Driver Harris Wire Co.
Alloy Metal Wire Co., Moore, Pa. . . . . C R . .
American Copper Products Corp., 233 Broadway, New York, N. Y. . . . . C R . .
American Electrical Works (Phillipsdale), Providence, R. I. . . . . C . . .
American Insulated Wire & Cable Co., Div. of General Cable Corp., 854 W. 21st, Chicago. . . . C . . S
American Steel & Wire Co., 208 S. La Salle, Anaconda Wire & Cable Co., 25 Broadway, New York, N. Y. . . . . C . . .
Anylite Elec. Co., Fort Wayne, Ind. . . . . C . . .
Ballast. See Gilby Wire Co.
Baltimore Copper Mills (Div. of General Cable Corp.), Baltimore, Md. . . . . C . . .
Bassett Metal Goods Co., Derby, Conn. (General Sales Agent, Hatheway & Co., 16 Hudson, New York, N. Y. . . . . C . . .
Belden Mfg. Co., 2310B S. Western Ave., Chicago C . . S
Beldenite. See Belden Mfg. Co.
Bradford, Kyle & Co., Plymouth, Mass. . . . . R . .
Braidite. See Cornish Wire Co.
Brenvar. See American Insulated Wire & Cable Co.
Bridgeport Brass Co., Bridgeport, Conn. . . . . C . . .
Calido. See Driver Harris Wire Co.
Chromel. See Hoskins Mfg. Co.
Chromic. See Murray-Harris Wire Co.
Climax. See Driver Harris Wire Co.
Comet. See Driver Harris Wire Co.
Comin. See Gilby Wire Co.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I. C . . .
Copel. See Hoskins Mfg. Co.
Copperweld Steel Co., Glassport, Pa. . . . . C . . S
Cornish Wire Co., 30 Church, New York, N. Y.. C . . .
Corwica. See Cornish Wire Co.
Crapo. See Indiana Steel & Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J.. C . . .
Cupron. See Gilby Wire Co.
Darow Mfg. Co., 36 E. 20th, New York, N. Y... C . . .
Detroit Insulated Wire Co., Detroit, Mich. . . . . C . . .
1885. See Chicago Insulated Wire & Mfg. Co.
Driver Harris Wire Co., Harrison, N. J. . . . . R . .
Electron. See Bassett Metal Goods Co.
Excellicier. See Branford Elec. Co.
Fullman Mfg. Co., 1209 Jefferson, Latrobe, Pa. . . . .
Gilby Wire Co., Riverside Ave., Newark, N. J. . . . R .
Goldmark Co., James, 83 Warren, New York. . C . . .
Hope Webbing Co., Providence, R. I. (Braided Wire Tape) . . . . . C . . .
Hoskins Mfg. Co., 4445 Lawton Ave., Detroit, Mich. . . . . R . .
Hudson Wire Co., Ossining, N. Y. . . . . C R . .
Ideal. See Driver Harris Wire Co.
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. . . . . C . . S
Indiana Steel & Wire Co., Muncie, Ind. . . . . S
Karma. See Driver Harris Wire Co.
Keystone. See Fullman Mfg. Co.
Lucero. See Driver Harris Wire Co.
Marion Insulated Wire & Rubber Co., Marion, Ind. C . . . .
Monex. See Standard Alloy Wire Co.
National-Harris Wire Co., 195 Verona Ave., Newark, N. J. . . . . R . .
Nehring Electrical Works, De Kalb, Ill. . . . . C . . .
Nichrome. See Driver Harris Wire Co.
Novar. See Standard Alloy Wire Co.
Page Steel & Wire Co., Bridgeport, Conn. . . . . S
Paranite. See Indiana Rubber & Insulated Wire Co.
Peerless. See Alloy Metal Wire Co.
Phillips Wire Co., Div. of General Cable Corp., Pawtucket, R. I. . . . . C . . .
Phono-Electric. See Bridgeport Brass Co.
Premier. See Alloy Metal Wire Co.
Providence Insulated Wire Co., Providence, R. I.. C . . .
Race. See Roes Wire Co.
Revolute Wire Co., Hastings-on-Hudson, N. Y.... C . . .
Rice Co., A. H., Pittsfield, Mass. . . . . C . . .
Roebling's Sons Co., John A., Trenton, N. J. . . . . C . . S
Rome Wire Co., Div. of General Cable Co., Rome, N. Y. . . . . C . . .
Ross Wire Co., 69 Bath, Providence, R. I. . . . . C . . .
Seneca Wire & Mfg. Co., Fostoria, O. . . . . S
Silicrimp. See Valley Narrow Fabric Co.
Silectron. See Standard Alloy Wire Co.
Solar. See Gilby Wire Co.
Sparg Wire Co., J. A., Rome, N. Y. . . . . C . . .
Standard Alloy Wire Co., Elizabeth, N. J. . . . . R S
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa. . . . . C . . .
Super-Insulated Wire Co., Plymouth, Mass. . . . . C . . .
Superior. See Alloy Metal Wire Co.
Talking Tape. See Hope Webbing Co.
Therlo. See Driver Harris Wire Co.
Tophet. See Gilby Wire Co.
Tru-Lay. See Page Steel & Wire Co.
Valley Narrow Fabric Co., Falls, R. I.
Wheeler Insulated Wire Co., Bridgeport, Conn.. C . . .

WIRE, Copper Clad

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Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa.

WIRE SOLDER. See Solder, Bar and Wire.

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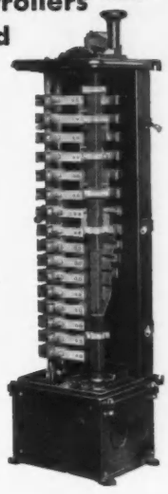

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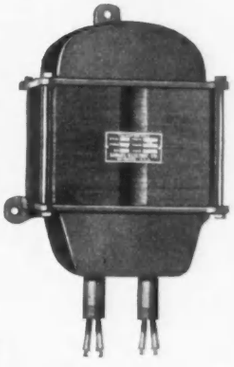

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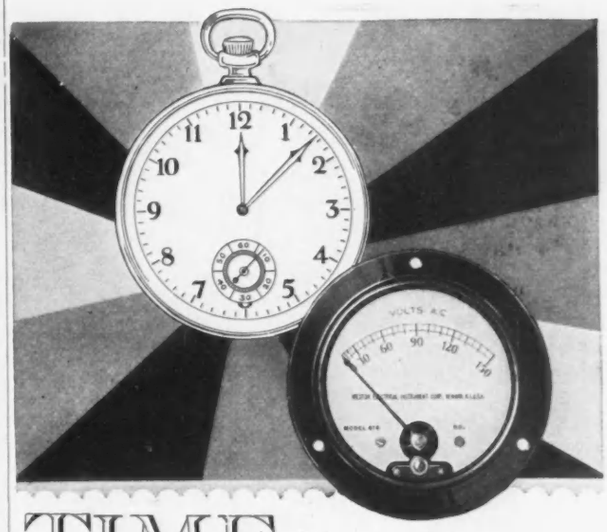

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Torrington Manufacturing Co., 70 Franklin, Torrington Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio.
Wire Machinery Corp. of Am., New Haven, Conn.

WIRE, Insulated

KEY

Annunciator, Office, Bell Wire....See A
Asbestos Covered Heater Cord.....See H
Asbestos Covered Magnet Wire....See M
Enameled Magnet Wire .....See M
Fixture Wire .....See R
Flexible Reinforced Heavy Duty Cord .....See F
Heater Cord .....See H
Ignition Cable .....See R
Lamp Cord .....See R
Magnet Wire .....See M
Rubber Covered Wire & Cable..See R
Stove Wire .....See H
Telephone Cord .....See T

A-A Wire Co. (Div. of General Cable Corp), 420 Lexington Ave., N. Y. C.. R
A-1 Brand. See American Insulated.
Acme Wire Co., New Haven, Conn. Enamaled Silk, Cotton ..... M
Amelectric. See American Elec.
American Braiding Co., Holyoke, Mass. R
American Brand. See American Insulated Wire & Cable Co.
American Copper Products Corp., 233 Broadway, New York, N. Y.
American Electrical Works (Philipsdale), Providence, R. I. ..... M
American Enameled Magnet Wire Co., Muskegon, Mich. ..... M
American Insulated Wire & Cable Co. Div. of General Cable Co., 954 W. 21st, Chicago, Ill. ..... M
American Insulated Wire Corp., Div. of General Cable Co., 45 Baker, Providence, R. I. ..... R F . . A T . .
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... R F H A T M
Americore. See American Steel.
Amerite. See American Steel.
Amerize. See American Steel.
Amparak. See American Steel.
Anaconda Wire & Cable Co., 25 Broadway, New York, N. Y. ..... R W . . A . . M
Anaconda Wire & Cable Co., Pawtucket, R. I. ..... R F . . . . . .
Anaconda Wire & Cable Co., Maring Wire Branch, Muskegon, Mich. (Silk, Enamel) ..... M
Ansonia Electrical Co., Ansonia, Conn. Silk, Cotton, Enameled..... A . . M
Armoriokt. See American Steel.
Bay State Insulated Wire & Cable Co., Paydras (Mattapan), 26, Boston..... R Chicago, Ill. ..... R F H A T M
Belden Mfg. Co., 2310B S. Western Ave., Beldenamel. See Belden Mfg. Co.
Beldenite. See Belden Mfg. Co.
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. ..... R F . . . . . .
Boston Insulated Wire & Cable Co., 65 Bay, Boston, Mass. ..... R F H . . . .
Bradford, Kyle & Co., Plymouth, Mass. ..... M
Cablex. See Collyer Insulated Wire Co.
Celatsite. See Acme Wire Co.
Collyer Insulated Wire Co., Pawtucket, R. I. ..... R F H . . . . . .
Colorbeston. See General Elec. Co.
Condex. See Simplex Wire Co.
Colorubber. See Belden Mfg. Co.
Copperweld Steel Co., Rankin, Pa..... R . . . . . T . .
Cotenamel. See Belden Mfg. Co.
Cottonite. See Acme Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J. ..... R F H A T M
Darow Mfg. Co., 36 E. 20th, New York. R . . . . . .
Davis-Jones Insulated Wire Co., Pawtucket, R. I. ..... R F H A T . .
Deltabeston. See York Insulated.
Detroit Insulated Wire Co., Detroit, Mich. R . . . . . T
Diamond Braiding Mills, Chicago Heights R F H . . . M
Di-Noburn. See Diamond Braiding Mill.
Dreadnaught. See Indiana Rubber Co.
Driver-Harris Co., Harrison, N. J..... R . . H . . . . .
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind. ..... M
Duratto. See Dudlo Mfg. Co.
Durablit. See Anaconda Wire & Cable Co.
Duracord. See Anaconda Wire & Cable Co.
Durawire. See Anaconda Wire & Cable Co.
Duro. See McEvoy, C. H.
Eagle. See Goldmark Co., James.
Eastern Insulated Wire Co., Tilton, N. H. R . . . . . .
1885. See Chicago Insulated Wire.
Enamelite. See Acme Wire Co.
Fibrex. See Simplex Wire Co.
Flexible Woven Cable Co., 755 Boylston, Boston, Mass. ..... F . . . . . .
Flex-O-Cord. See Packard Elec. Co.
Garco. See General Asbestos Co.
Gavitt Mfg. Co., West Brookfield, Mass. ..... T . .
GE-Flex. See General Elec. Co.
General Asbestos & Rubber Co., Charleston, S. C. ..... H . . . . .
General Elec. Co., Merchandise Dept., Bridgeport, Conn.... R F H . . . M
Giant. See Collyer Insulated Wire.
Goldmark Co., James, 83 Warren, New York, Annunciator and Asbestos, Cotton, Silk and Enameled Magnet ..... A . . M
Goodyear Rubber Insulating. See Graybar Electric Co.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y. R . . . . . T . .
Grimshaw. See New York Ins.
Hatex. See Hatfield Rubber Wks.
Hatfield Rubber Wks., Inc., Hillside, N. J. ..... R F H . . T . .
Hazacord. See Hazard Insulated Wire Works.
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.... R F . . A . . .
Holyoke Co., 621 Broadway, New York.. R . . . . A . . M
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... R F H . . . . . .
I. X. L. See Collyer Insulated.
Kable. See Safety Cable Co.
Kenrite. See American Insulated.

Kerite Ins. Wire Cable Co., 30 Church, New York, N. Y. ..... R . . . . . .
Kilo, Co., 2 E. 23d, New York..... . . . . T M
Koelle, Frederick C., Real Estate Trust Bldg., Philadelphia, Pa. .... T . .
Lowell Insulated Wire Co., Lowell, Mass. R F H . . . . .
Liberty. See Nat. Metal Molding
Loxsteel. See Hazard Insulated Wire Works
McEvoy, C. H., Lowell, Mass..... R . . . . . T . .
Marion Insulated Wire & Rubber Co., Marion, Ind. ..... R F H A T . .
Massachusetts Elec. Mfg. Co., West Lynn, Mass. ..... M
Montgomery Co., J. R., Windsor Locks, Conn. ..... T . .
National Elec. Products Corp., Pittsburgh, Pa. ..... R F H A T M
N. E. See Goldmark Co., James.
New York Insulated Wire Co., 114 Liberty, New York, N. Y. ..... R . . . . . .
Nitro. See Belden Mfg. Co.
O. K. See Phillips Wire Co. Also
Okocord. See Okonite Co.
Okonite Co., Passaic, N. J..... R . . . . . .
Ozex. See Simplex Insulated Wire
Packard Electric Co., Warren, O..... R F . . . . . .
Parac. See Phillips Wire Co.
Paracore. See U. S. Rubber Co.
Paraflex. See Bishop Wire & Cable.
Paranite. See Indiana Rubber.
Parkerite. See Seward Wire Co.
Peco. See Packard Elec. Co.
Philadelphia Insulated Wire Co., 200 N. Third, Philadelphia, Pa..... H A T . .
Phillips Wire Co., Div. of General Cable Corp., Pawtucket, R. I. ..... R . . . . . .
Providence Insulated Wire Co., Providence R F H A . . . .
Raven Core. See New York.
Reliance. See American Steel.
Rockbestos Products Corp., Nicoll & Conner Sts., New Haven, Conn..... R . . H . . T M
Roebling's Sons Co., John A., Trenton, N. J. ..... R F H A T M
Rome Electrical Co., Inc., Div. of General Cable Corp., Rome, N. Y. ..... M
Rome Wire Co., Rome, N. Y..... R F H . . T M
Ross Wire Co., 69 Bath, Providence, R. I.. R . . . . . .
Runzel-Lenz Elec. Mfg. Co., 1751 N. Western Ave., Chicago, Ill..... . . . . T . .
Safety Cable Co. (Div. of General Cable Corp.), New York ..... R F H . . . . .
Salamander. See York Insulated.
Seward Wire Co., Parkersburg, W. Va. R . . . . . .
Silkenamel. See Belden Mfg. Co.
Silkenite. See Acme Wire Co.
Simcore. See Simplex Wire.
Simplex Wire & Cable Co., 83 Sydney, Cambridge, Mass. ..... R F . . . . . .
Shield. See Ansonia Elec'l Co.
Southern States Cable Co., Div. of General Cable Corp., Mobile, Ala..... . . . . M
Spiralweave. See Hazard Ins. Wire
Standard Alloy Wire Co., Elizabeth, N. J. . . . . H . . . . .
Standard Underground Cable Co., Pittsburgh, Pa. (Div. of General Cable.) R F H A T . .
Sterling. See Standard Underground.
Sterling Insulated Wire Co., Fall River, Mass. ..... R . . . . . .
Strand & Sweet Mfg. Co., Winsted, Conn. . . . . M
Super-Service. See Rome Wire Co.
Sweetstrand. See Strand & Sweet.
Tip-Top. See Standard Underground.
Tirex. See Simplex Wire & Cable.
Trenchlay. See Rome Wire Co.
Triangle Conduit Co., Dry Harbor Rd. & Cooper Ave., Brooklyn..... R . . . . . .
Tubular Woven Fabric Co., Pawtucket, R. I. ..... R F . . . . . .
United States Rubber Co., 1790 Broadway, New York, N. Y. ..... R . . H A T . .
U. S. Royal. See United States.
Varflex Corp., Rome, N. Y. .... M
Warrior. See American Copper.
Wheeler Insulated Wire Co., Bridgeport, Conn. ..... R F H A T M
White, J. M., 1128 Oliver, Philadelphia, Pa. ..... R F H . . T . .
Whitney Blake Co. See Graybar Electric Co.
Wovenite. See Flexible Woven.
York Insulated Wire Wks. of G. E. Co., 120 Broadway, New York, N. Y..... R . . H . . . . M

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Commercial Rayon & Thread Co., 19 W. 21st, New York, N. Y.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Florsheim, H. A., 225 Fifth Ave., New York, N. Y.
Franklin Rayon Corp., 86 Crary, Providence, R. I.
General Electric Co., Schenectady, N. Y.
Great Lakes Yarn & Thread Co., Div. of General Cable Corp., 5133 Wesson Ave., Detroit, Mich.
Johns-Manville Corp., New York, N. Y. (Asbestos.)
Keasbey & Mattison, Ambler, Pa.
Lees Mfg. Co., 320 Broadway, New York, N. Y.
Multiple Winding Co., 77 Summer, Boston, Mass.
Rich & Co., H. S., 180 S. Water, Providence, R. I.
Ryle & Co., Wm., 381 Fourth Ave., New York, N. Y.
Silkelip. See Worcester Bleach & Dye Wks. Co.
Smith & Dove Mfg. Co., Andover, Mass. (Linen Thread.)
Worcester Bleach & Dye Wks., Worcester, Mass.

ZINC

Horse Head. See New Jersey Zinc Co.
New Jersey Zinc Co., 160 Front, New York, N. Y.
Platt Bros. & Co., Waterbury, Conn. (Strips.)
United Metals Selling Co., 25 Broadway, New York, N. Y.

ZINCS AND COPPERS, Battery

Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Edes Mfg. Co., Plymouth, Mass.
Extruded Metal Corp., 184 53rd, Brooklyn, N.Y. (Zinc Cups.)
Franklin. See Grasselli Chemical Co.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Illinois Zinc Co., Peru, Ill.
Lind Mfg. Co., 70 Wyckoff Ave., Brooklyn, N.Y. (Zinc Cups.)
Matthiessen & Hegeles Zinc Co., La Salle, Ill.
New Jersey Zinc Co., 160 Front, New York, N. Y.

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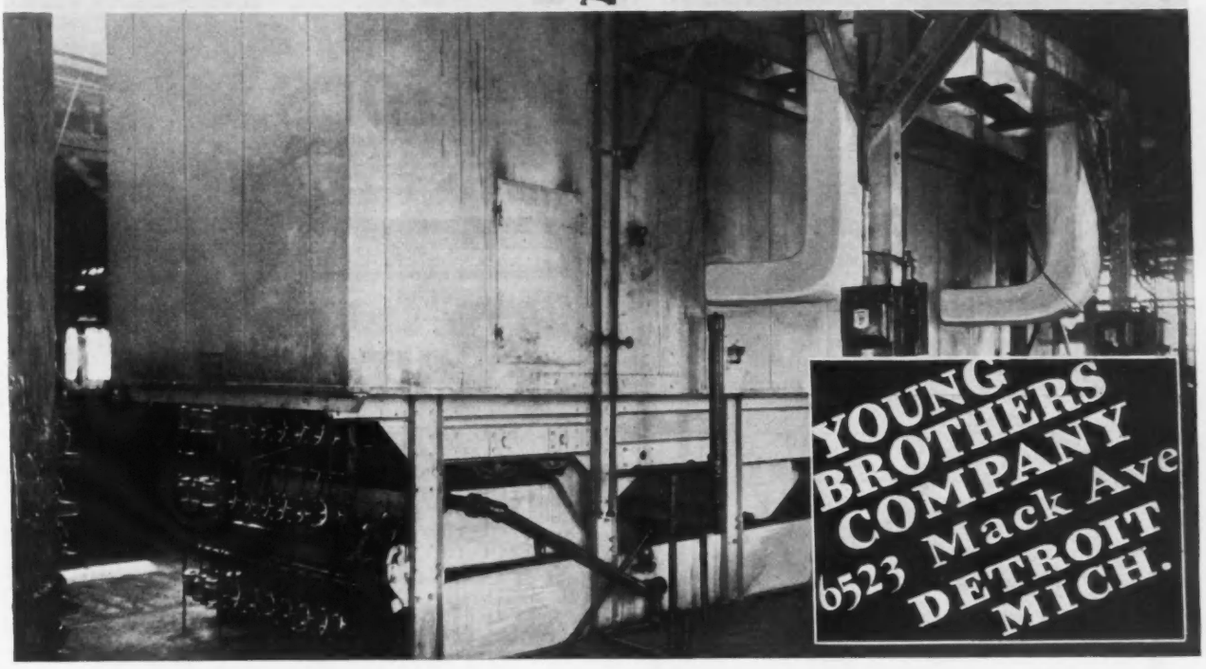

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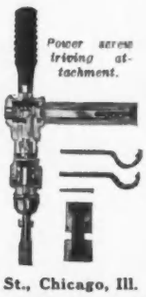

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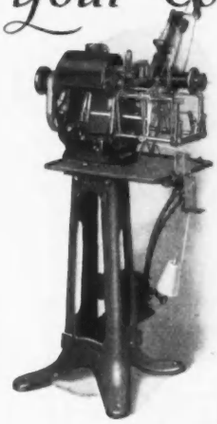

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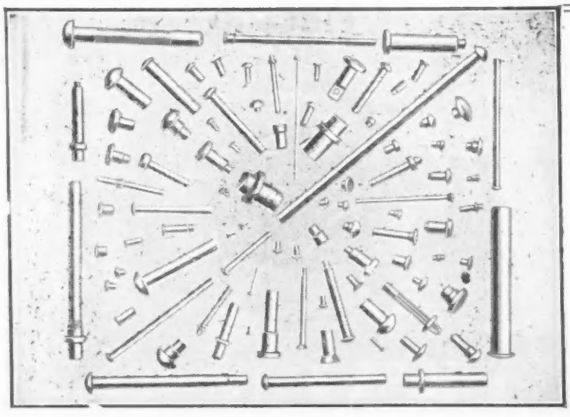

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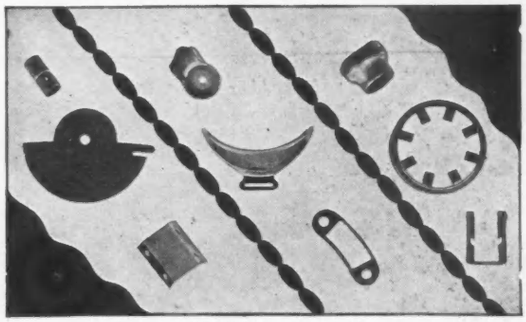

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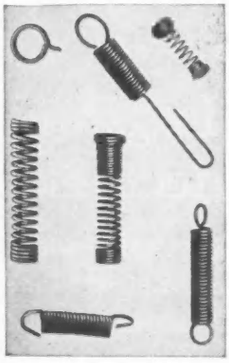

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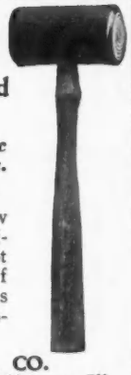

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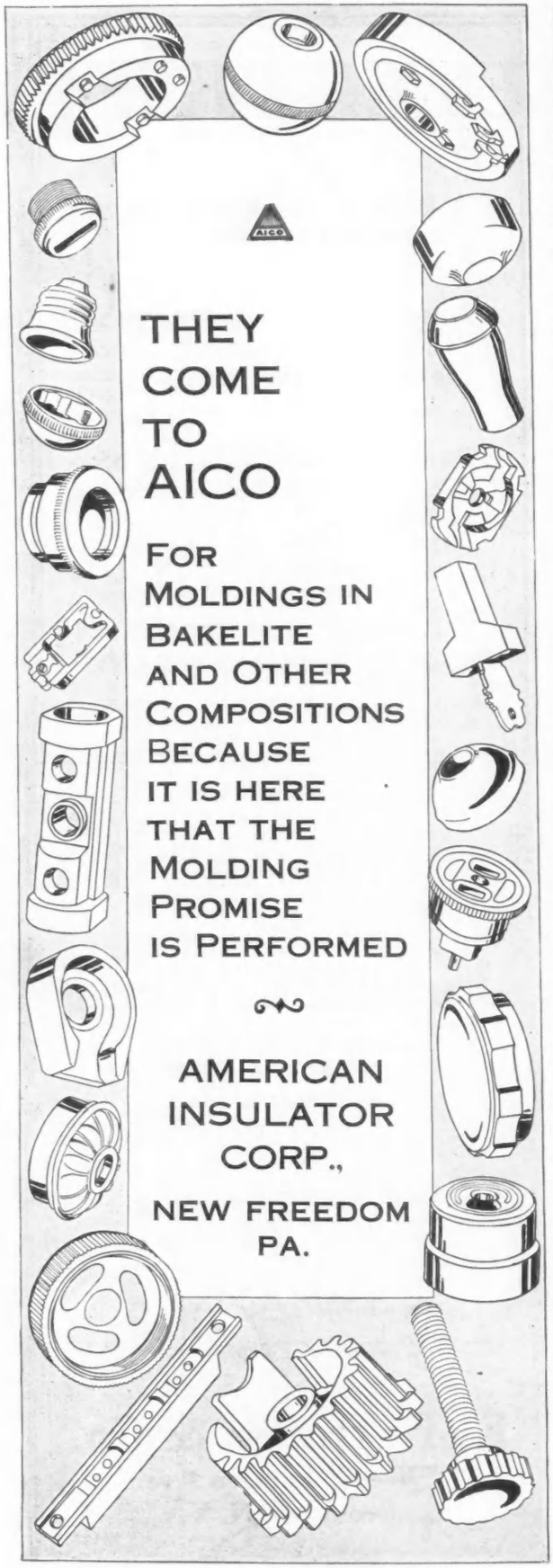
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Index to Advertisers

Acme Products Co. 125
Acme Wire Co., The.....123
Advance Spring & Wire Co.....128
Akron Porcelain Company, The 115
Allen & Hills, Inc. 98
Aluminum Co. of America..... 85
Ambler Asbestos Shingle & Sheathing Co. 8
American Insulator Corporation.130
American Lava Corporation....107
Angle Steel Stool Co..... 97

Badger Die Casting Co..... 88
Bakelite Corporation 91
Baker & Company, Inc.....102
Barnes Co., The Wallace.....111
Barnhart Brothers and Spindler. 87
Baumbach Mfg. Co., E. A..... 87
Bead Chain Mfg. Company, The 126
Becker Brothers Elec'l Corp.....119
Beckwith Machine Company The 113
Belden Mfg. Company Inside Front Cover
Bohn Aluminum & Brass Corp. 12
Brand & Company, William....111
Brandywine Fibre Products Company 107
Brawley, T. R. 105
Burgess & Company 115

Candy & Company, Inc.....126
Case Brothers, Inc. 129
Celluloid Corporation 20
Chace Valve Co., W. M.....116
Chandler Company, The.....100
Chapman Elec. Works, P. E...119
Chicago Mica Co. 109
Chicago Rawhide Mfg. Co., The 128
Chicago Wire Chair Co., The..101
Cochrane Chemical Co.....120
Colonial Insulator Company....107
Connecticut Molded Products Corp. 101
Conran, Fredk. M. 120
Consumers Rubber Co., The.. 92
Container Corp. of America..17-18
Cook Pottery Company....96-98-102
Cooke Seal Ring Co. 113

Davis Slate & Mfg. Company..110
Delbee Rubber Co. 97
Derby Commutator Co., The..119
Deutschmann Corp., Tobe.....14-15
Dolph Company, John C.....100
Dudlo Manufacturing Co. 9
Dumore Company, The..... 19
Dunn, Inc., Struthers.....117

Electric Valve Mfg. Company.. 90
Electrical Refractories Co., The.109
Electrical Testing Labs..... 97
Eureka Metal Prod. Corp.....115

Fair Haven Marble & Marbleized Slate Co. 110
Fibroc Insulation Co. 105
Fischer Spring Co., Chas...112-118
Formica Insulation Co., The.... 4
Franklin Die Casting Corp..... 88

Gage Publishing Co., Inc. The.. 93
Gair Company, Robert Insert Between 12-13
Garfield Mfg. Company 98
General Electric Company...7-22-89
General Etching & Mfg. Co.....100
General Plastics, Inc., ... 16
Gibson Co., Wm. D.....125
Gilby Wire Company 120
Gray Brothers, Inc. 88

Handy & Harman 127
Hardwick, Hindle, Inc.....124
Hartford City Paper Co..... 99
Highland Elec. Chemical Co....126
Hinde & Dauch Paper Co., The 21
Hunter Pressed Steel Co.....112

Impervious Varnish Co.....100
Insulation Products Co. 98
International Insulating Corp... 95
Interstate Products Corp. 119

Johns-Manville Corp. 81

Kendrick & Davis Company....124
Kliegl Bros. 117
Kuhn & Jacob Machine & Tool Co. 101

Leland Electric Co., The.....113
Linden & Company 108

Maas & Waldstein Co. 103
Macallen Co., The 83
Mass. Machine Shop, Inc.....128
Master Electric Co., The 3
Mercer Porcelain Co., Inc.....102
Meyercord Co., The....Front Cover
Mica Insulator Company..... 69
Mid-West Box Co.,.....17-18
Mitchell-Rand Mfg. Co. 126
Munsell & Co., Eugene.....101

National Electric Controller Co. 124
National Vulcanized Fibre Co... 67
New Departure Mfg. Company, The 71
New England Screw Co.....128
New Jersey Zinc Co., The.... 10
Newton Die Casting Corp., The 73
Norton Laboratories, Inc. 98

Ohio Elec. & Controller Co., The 79
Olson Mfg. Company 108

Parker-Kalon Corp. Inside Back Cover
Patton-MacGuyer Co. 128
Peck Spring Co., The 128
Phosphor Bronze Smelting Co., The 123
Platt Bros. & Co., The 129
Portland-Monson Slate Co.....110
Progressive Manufacturing Co. The 126
Pyramid Products Co. 128

Reade Mfg. Co.....112
Reynolds Spring Co. 103
Rome Electrical Company, Inc...119
Royal Metal Mfg. Company ..122
Rubicon Co., The 117
Ruby Chemical Co., The.....112

Scranton Button Co., The Back Cover
Shakeproof Lock Washer Company 11
Shaw Insulator Company 98
Signal Elec. Mfg. Co.....124
Sorgel Electric Company.....121
Standard Alloy Wire Co., Inc. 119
Star Porcelain Company, The....109
Steinen & Company, William...108
Stewart Die Casting Corp., The 75
Strand & Co., N. A.....124
Stupakoff Laboratories, Inc..... 99
Sundh Electric Company, Inc... 90
Synthane Corporation 87

Thomas & Sons Co., The R.....115
Thordarson Elec. Mfg. Co.....118
Torrington Co., The 13
Toycraft Rubber Co., The.....111
Trotter & Co. E. T.....129
Twin City Die Castings Co..... 88

Udylite Process Co., The..... 6
Union Electric Mfg. Company..121
Universal Winding Company....125

Vim Electric Tool Co. 119

Waterbury Button & Moulding Co. 99
Waukegan Chemical Company..100
Western Felt Works 90
Weston Elec'l Instrument Corporation 121
West Virginia Pulp & Paper Co. 129
Wheeler Insulated Wire Co., The 120
Wiegand Co. Edwin L..... 77
Wilcolator Company, The.....117
Wilmington Fibre Specialty Co. 97
Wire Stripper Co., The 119
Wolverine Tube Co.....127
Woolley, Inc., W. Douglas.....102

Young Brothers Co. 123

Zeller Lacquer Mfg. Co., Inc...103

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Eliminated!

tapping . . . crossed threads . . . scrapped parts

by making fastenings with Hardened Metallic Drive Screws

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REG U S PAT OFF
DRIVE SCREWS

PAT. JAN. 29, 1924 No. 1482151 - OTHERS PENDING

For Making Fastenings to Iron, Brass and Aluminum Castings, Steel, Bakelite, etc.

Parker-Kalon Corporation
190-204 Varick St., New York

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Name .....

Address .....

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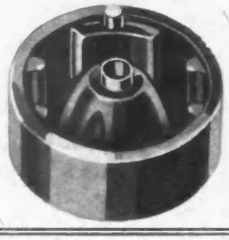
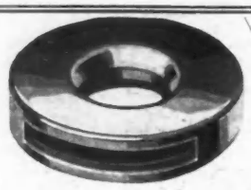


Moulding minus the headaches



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419 Cherry St.

CHICAGO, ILL.
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retained by us are always repaired, insured and renewed, if necessary, without additional expense to the customer unless otherwise agreed.

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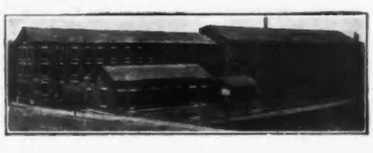
Auburn Plant, Auburn, New York



Sept. 1929

Electrical Manufacturing

Vol. 4 A Gage Publication No. 3

The Acknowledged Standard of Quality Since 1884

Pyroxylin Lacquers

for every industrial purpose

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STAMFORD, CONN.

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YOU CAN HAMMER THE BELDEN SOFT RUBBER PLUG- IT WONT BREAK
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For Home Appliances

Belden Soft Rubber Plugs are furnished in black or brown, with or without long shanks as illustrated, and on any kind of conductor desired cut to specifications.

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You should have the complete story which shows the preference of housewives and dealers for appliances equipped with Belden Soft Rubber Plugs.

Write today for this important information and prices.

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Coil Windings
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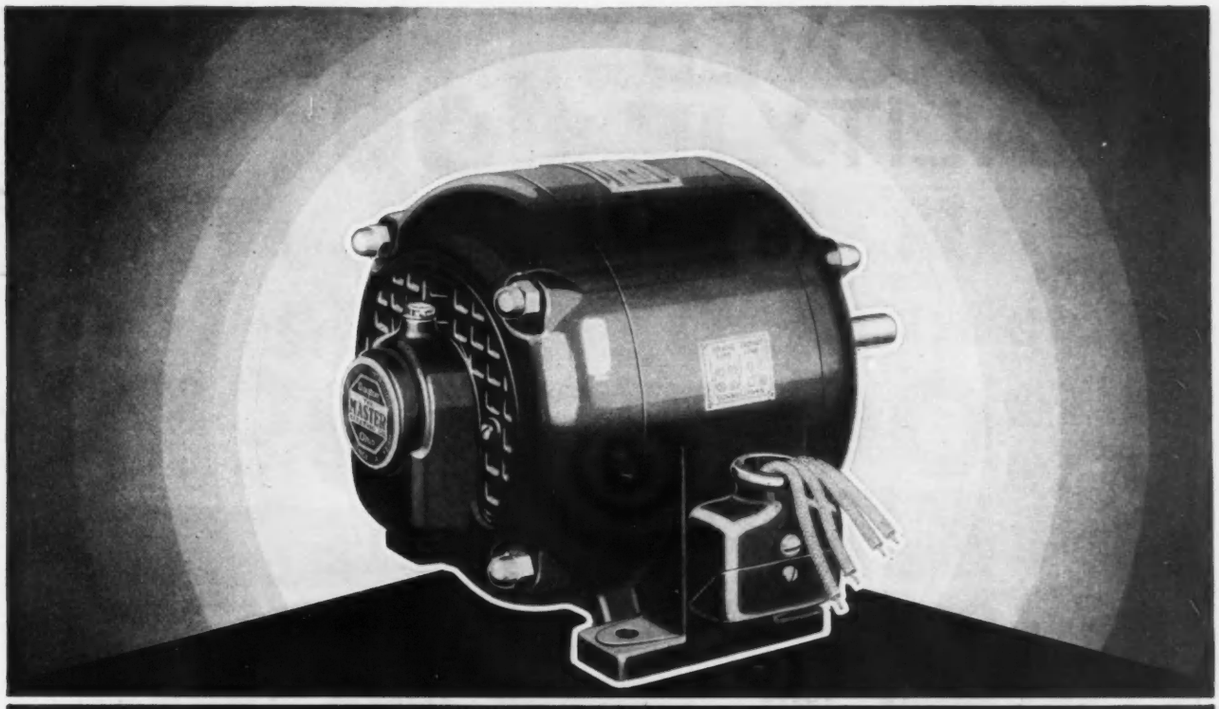

Twenty Motors!

GATHERED at random from each week's production, they are taken to our Engineering Department.

There a group of our designing and production engineers put them through exhaustive inspection tests.

They overload them—they check castings—finish and general appearance—they look for end play, vibration, insulation rubbing, magnetic hum and noise. They tear them down and go over every part. They are not looking for perfection—they are after flaws.

And, if a motor does not stand the gaff, they find out why.

The report of these tests is presented to our Quality Club, made up of the men in charge of every production department.

Causes for every flaw are immediately removed.

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Dayton, Ohio
Manufacturers of Master Guaranteed Motors

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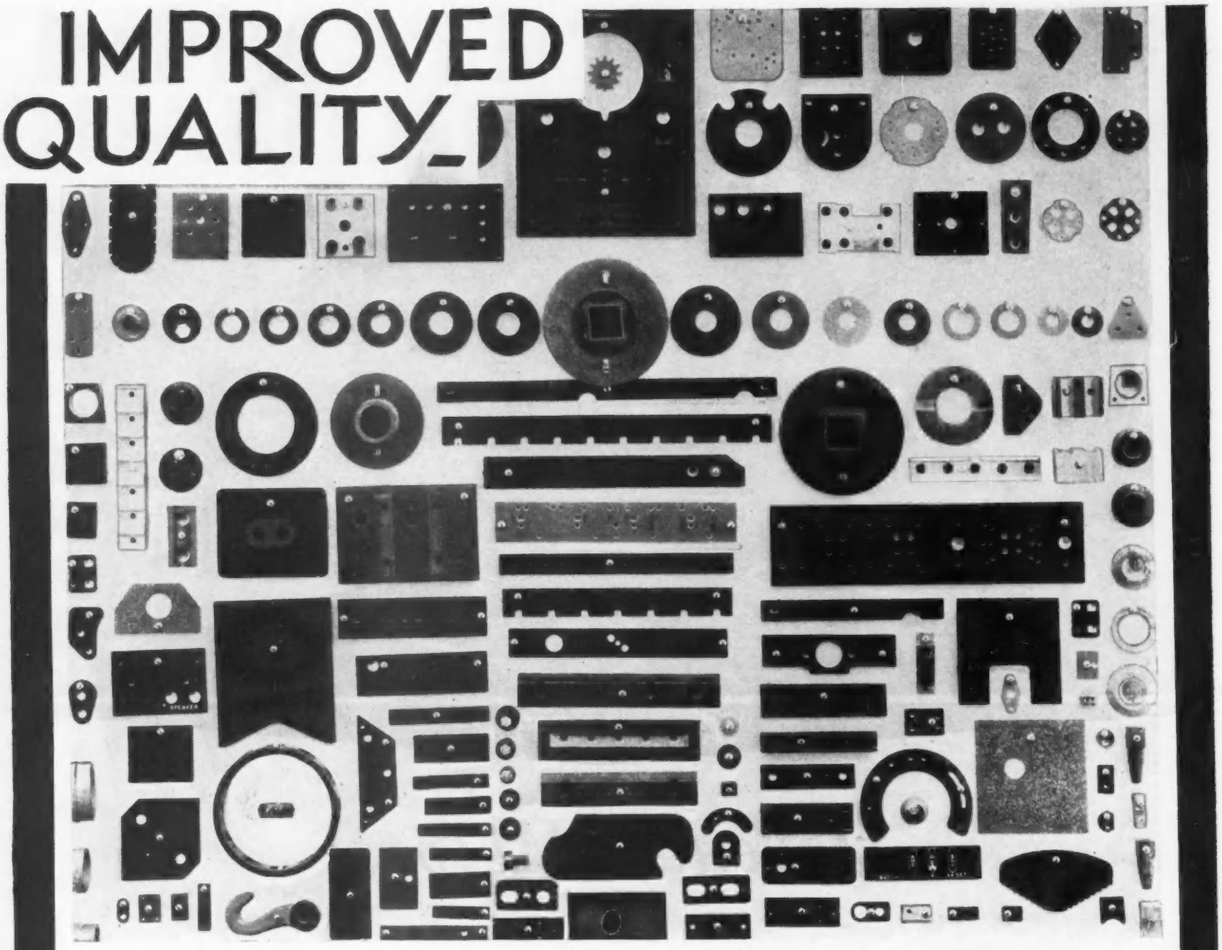
Dayton THE MASTER ELECTRIC CO. Ohio
MORE THAN 100 SERVICE STATIONS
NOT MORE THAN 40°

IMPROVED QUALITY...



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RESEARCH work never ends in the Formica laboratories. Materials and methods are constantly under study and occasionally something important develops.

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The fact that leading American electrical organizations have used it without a break for 10 to 15 years is evidence that better insulation is not obtainable.

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Electrical Manufacturing

Reg. U. S. Patent Office

Volume 4 SEPTEMBER, 1929 Number 3

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ELECTRICAL MANUFACTURING's editorial program has the following objectives:

Production

To help all electrical manufacturers, including makers of motor-driven products, increase the product's salability, cut unit production costs, quicken turnover, reduce overhead expenses, establish standard methods of work, and spread a better knowledge of raw materials and parts.

Marketing

To spread a better knowledge of and aid electrical manufacturers in adjusting sales management to the buyers' market, to aid in making advertising more effective, finding the most profitable distribution channels, and promoting cooperative market development.

Administration

To further the working out of sounder management policies and better executive control, coordinating sales and production schedules, promoting research, and developing better industry relations.

Repairing

To help all motor repair shops to build better business by developing a sounder organization, improving management, policies and methods, and developing a keener merchandising point-of-view on the business.

Contents of This Issue

Census of Distribution Will Aid All Industries *Frederick M. Feiker* 19
Here Is a Market for Electrical Products ... 22
Leagues Hear Plan for Manufacturers' Support ... 24
Silver Solder—Its Uses in the Electrical Industry *William Crawford Hirsch* 25
Rod and Wire Forming Data and Methods ... *J. K. Olsen* 27
Some Recent Developments in Circuit Breaker Construction ... *J. E. McGee* 30
Making an Essential Electrical Product ... *William W. Baxter* 33
Commutator Production ... 35
Spray Finishing Fundamentals ... *Paul W. Collins* 39
Should Advertising Appeal to Woman's Martyrdom? *Phyllis Krafft Dunning* 42
Editorials ... 46
A Manufacturer's Suggestions for Designing Springs *L. D. Granger* 48
Characteristics Determining the Selection of Motors *Theodore Schou and C. P. Robinson* 51
Nema News ... 54
Rebuilding Motors for Resale ... *William Wallace* 55
Checking and Testing Motor Applications ... *D. H. Braymer* 58
Business Conditions as Reflected in Average Wage Earnings 60
Electric Percolator Parts ... 61
Facts, Figures and Trends ... 62
Electrical Manufacturing News ... 68
Index of Raw Materials, Parts and Electrical Equipment ... 80

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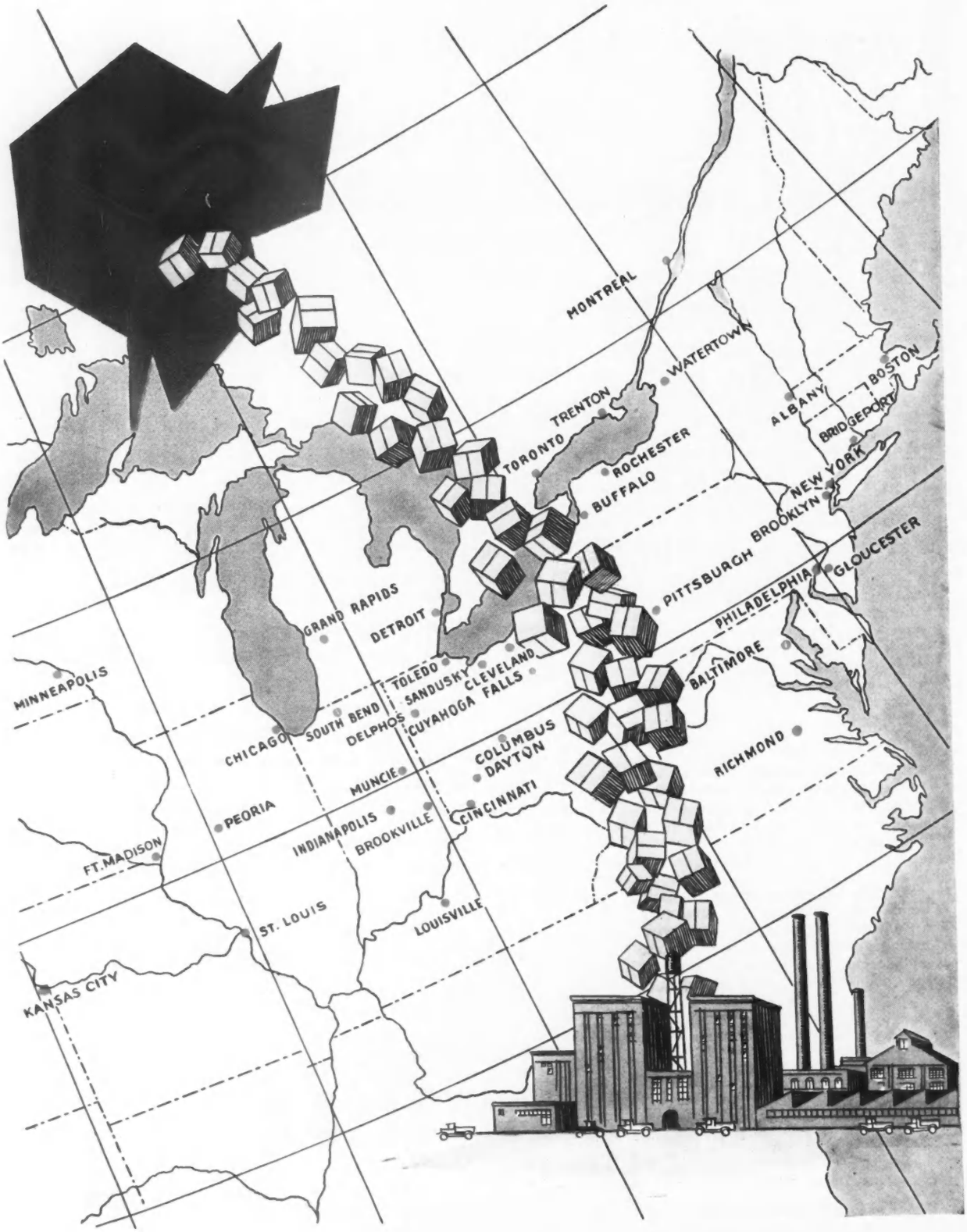

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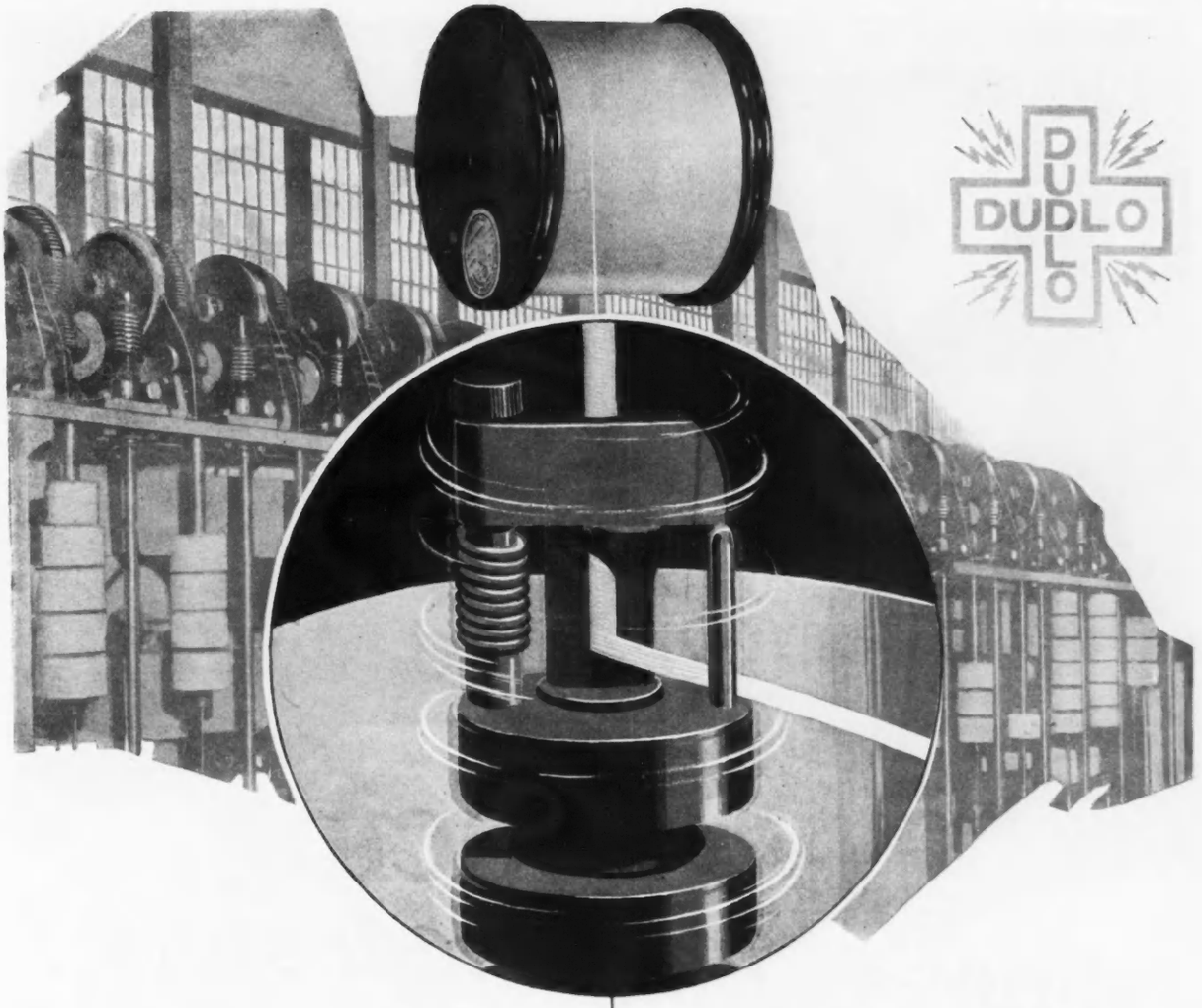

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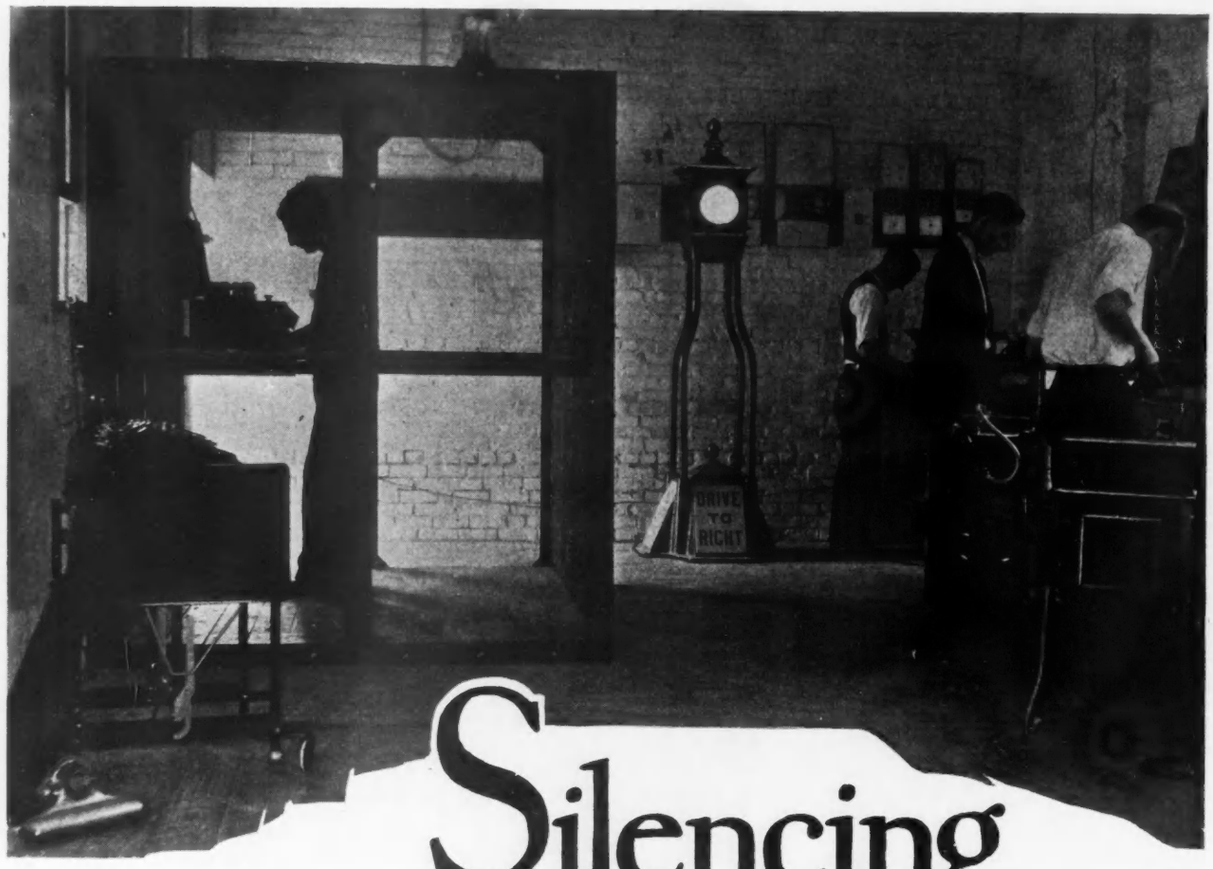

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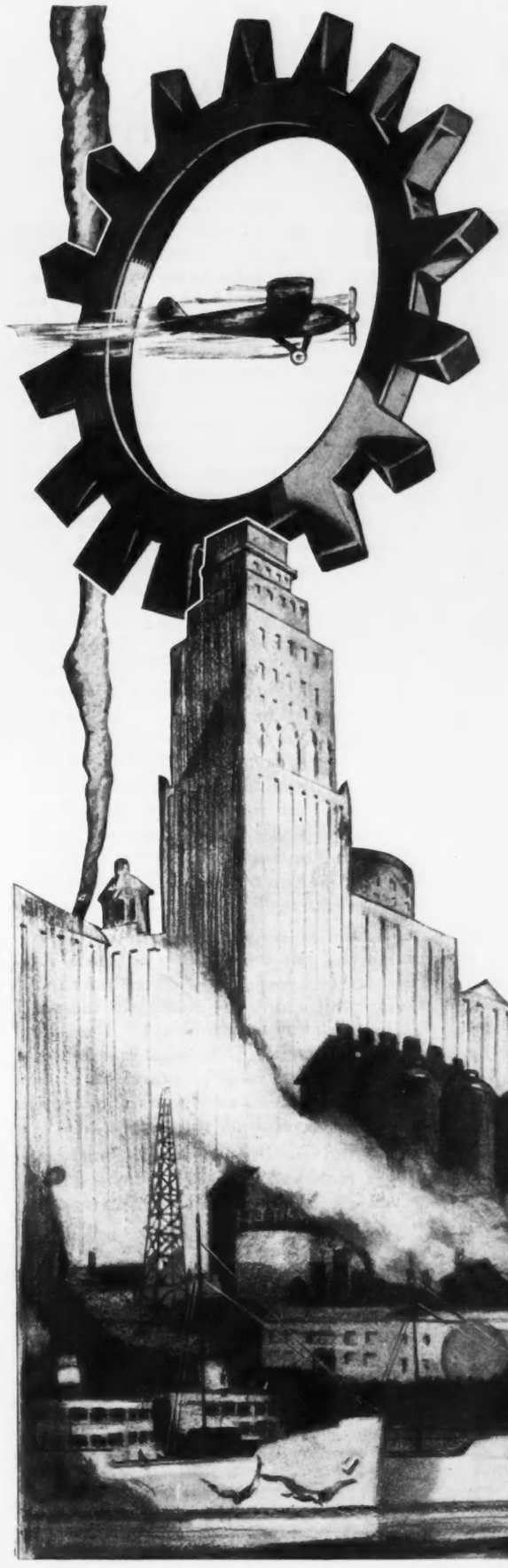

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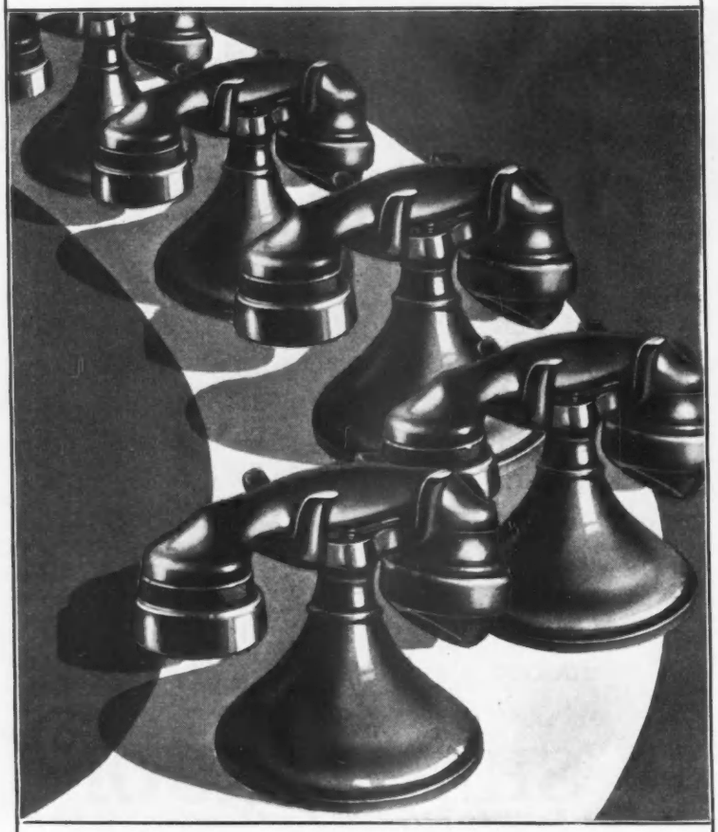

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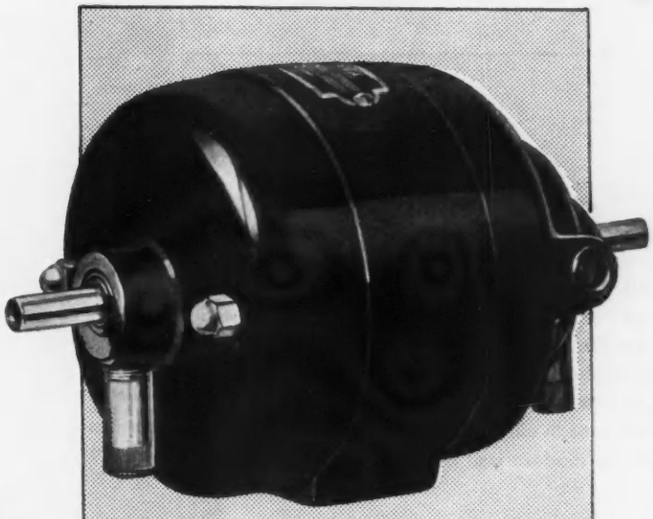

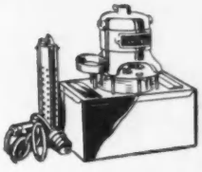

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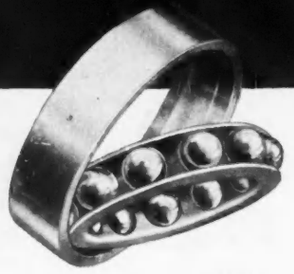

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Division of General Cable Corporation
ROME, NEW YORK

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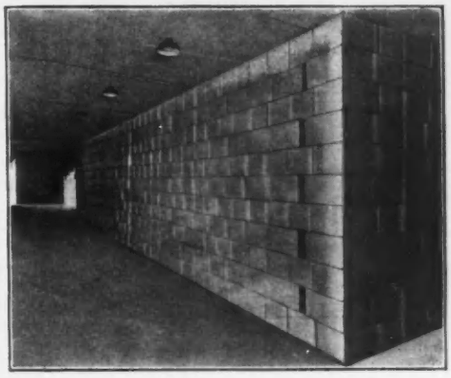

Gair Corrugated Cases have the squareness and sustaining strength necessary to tall stacking. They are built with an eye toward warehousing.

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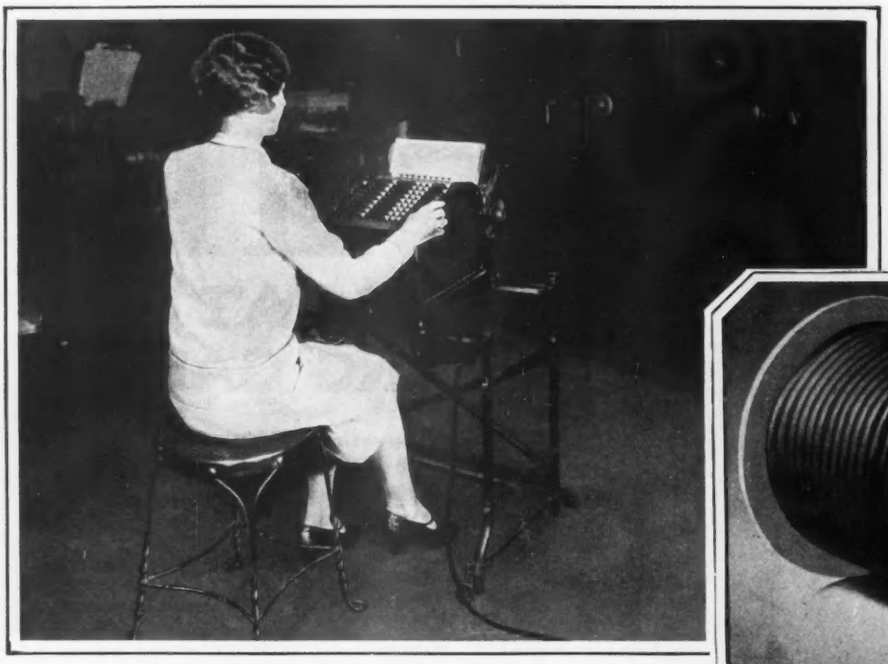

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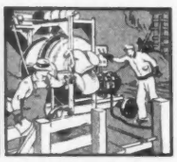

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Electrical Manufacturing

Production - Marketing - Administration - Repairing

Volume 4 SEPTEMBER - 1929 Number 3

Census of Distribution Will Aid All Industries

The new census will be an enumeration or count and not a survey, and it will not be a market analysis but will supply information that trade groups and individuals may put into practice

By Frederick M. Feiker

Chairman of the Advisory Committee of the Census of Distribution

Photo—Underwood & Underwood

Frederick M. Feiker

THERE MAY be said to be a two-fold reason why the electrical industry and trade should have more than ordinary interest in the coming census of distribution.

The original committee of industry and trade which promoted the values to business of a count or enumeration of mercantile establishments in the United States, was headed by Mr. Owen D. Young—then acting on appointment by Secretary of Commerce Hoover, as chairman of the Committee on Business Figures of the Distribution Conference of the United States Chamber of Commerce. I had the honor to be vice-chairman of that committee.

IN addition to his position as chairman of the Advisory Committee of the Census of Distribution, Mr. Feiker is a former vice-president of The Society for Electrical Development, Inc. He is also managing director of the Associated Business Papers, and was assistant to the Secretary of Commerce, Herbert Hoover.—The Editor.

It was at a meeting of the Committee on Business Figures, held in Mr. Young's office three years ago, at which Director Stewart of the Bureau of Census proposed an experimental Census of Distribution of eleven cities from which has developed first a better understanding of the values of such figures to every business man and second, a more intimate knowledge of how to get the figures with the least inconvenience to the individual business.

It has been said many times that the present problems of business are problems of distribution. To put it more concretely we are all trying to find ways, whether we are manufacturers, public utilities, jobbers or retailers, to widen markets, to increase sales and to reduce sales costs per unit of product sold.

It is equally true that most of the discussion of this question is conversation, not because good theories are not advanced, but because there is little actual known factual material to support theories. Meanwhile, of course, nobody is shutting up shop because he has no figures. Rather he is blundering through, "putting it up to the salesman," or blaming the

retailer or satisfying himself with increasing percentage ratios of cost with what somebody has facetiously termed "the minor profits," as his annual guide.

Nobody can hope that the coming census will solve selling. It seems to me that the Census will do two things.

First: It will supply a classified body of statistics on (a) the number of retailers by different lines, (b) the volume of their business, (c) some classification of commodities sold, (d) some beginnings of knowledge of the volume of commodities sold through different groups, (e) some comparison between one class of trade and another in different territories, (f) more basic information for a manufacturer in formulating sales quotas, (g) some basic information for jobbers and retailers about the flow of commodities and the percentages they handle.

Second: It will start everybody thinking about sales costs.

I am not sure that the first census will be most valuable as an instrument of industrial and trade education in selling. I have believed that the dismal but necessary practices of cost accounting were set forward by the income tax blanks. Once a year, anyway, we have to know where we stand—did we make or lose money. The enforced balance sheet, known as the "Income Tax Schedule" may be said to be, in that sense, an educational document.

The new census will be an enumeration or count and not a survey. It will not be a market analysis. But it should supply information which trade groups and individuals may put into practice.

From the activities which will be promoted by the census more business men will be conscious of the opportunity for trade analysis than ever before.

Every man has probably either asked or answered this question once today—"Well, how's business?" Next to the weather, business is the greatest starting point for a conversation, with the possible exception of "How's your golf game?" In the right hand upper corner of your favorite newspaper you learn each day the answer to the question, "How's the weather?" It may not be many years before in the left hand upper corner you will find a condensed answer to the question, "How's business?"

So universal is this question, so important to the everyday conduct of trade, that it is not strange that business men have asked the Government to help them find the answer. Eight years ago, when President Hoover became Secretary of Commerce, he called together at Washington group after group of business men representing all kinds of business and asked them how the Department of Commerce could aid industry and trade. As a result of meeting with scores of committees there were established a series of activities and services in the Department of Commerce, all tending to provide ways and means of reducing great areas of waste in the production and in the distribution of commodities. From these meetings with manufacturers and retailers, engineers, bankers, exporters, advertising men, and scores of other groups, there were established many helpful services to industry and trade.

No government in time of peace has ever developed so highly organized and effective a service as has been developed in the Department of Commerce. This work has saved millions of dollars to industry and trade. It represents also the greatest development of teamwork in business. Participating in this organized effort to reduce wastes have been the business organizations such as the United States Chamber of Commerce, hundreds of trade associations, technical and scientific societies, and the organized trade and technical press. One great fact has stood out from this eight years of analysis and service of business. We need more detailed facts to do business at a profit. The rule of thumb is passing. Manufacturers applying invention, labor-saving machinery, power, new management methods, have cut the costs of production. Wages have been maintained and increased, costs reduced, and the sale of commodities extended into thousands of homes.

All these improvements have come through better knowledge of costs. In a word, we have learned how to measure and control costs of production.

We are still in the initial stage of finding how to control the costs of distribution. Great areas of waste exist, not through the fault of the individual but because the individual does not know. When you discover, as one jobber did by analyzing his sales and profits, commodity by commodity, that he could make more money by reducing his volume, statistics meant something to him.

We have many rules-of-thumb in business. One is "I must have a complete line." Probably there is more money tied up in inventories, more stock getting dusty on shelves, and more loss in distribution from this rule-of-thumb than any other. Manufacturers working with the Division of Simplified Practice of the Department of Commerce, have found that it is possible to save thousands of dollars in inventory and increase turnovers for the retailer by eliminating lines. In one case a line was cut, in one conference between maker and seller, from 66 styles and varieties to 11.

The present Census of Distribution is not entered into blindly, but represents the results of cooperative work by business men and government during the past eight years for a definite objective.

It is perhaps the greatest piece of team-work between business and government that has been organized since the War Industries Board was formed. For the first time, in our commercial life, every business man in practically every line of trade and industry will be asked to take part. Facts and figures will be gathered which will have a far-reaching effect on the future prosperity of every business man in our country.

When you receive a tabulated statement of queries about your business, or when some day in early spring next year our enumerator from the Bureau of the Census calls at your place of business to ask what may seem like a lot of impertinent questions, remember that he is your representative in the Government. He is asking these qustions for your information and not just for the sake of satisfying curiosity.

As business men, we have asked the Bureau of the Census to count the number of men engaged in various classes of wholesaling and retailing; to inquire into the capital invested in each of these businesses; to supply information as to the volume of sales of different classes of commodities

Some of the Things a Census of Distribution Cannot Do

"IT would be wise to sound one note of warning with regard to this coming census of distribution.

"Business men should not entertain too high hopes, or cherish too confident expectations, as to what the census will do for them individually.

"The census will be a highly important economic study, but we can hardly expect that it will prove a panacea, immediately yielding large profits and resulting in miraculous transformations.

"A manufacturer who expects that the census of distribution will give him a precise, infallible record of what happens to his mouse-traps, or shaving brushes, or alarm clocks in every mercantile establishment between his factory door and the consumer's home is, inevitably, doomed to disappointment.

"Such a thought is extravagant, and a moment's thought will show the impracticability of attempting to present any such detail."

We have asked the Bureau of the Census to make this master analysis of our great sales and distributing machine because through that bureau every piece of this data is confidential, every man engaged in the task of collecting the figures is sworn to secrecy, and no figures are published which reveal the individual business of any enterprise or establishment.

Secretary Lamont mentioned, in an address, the conferences of the Advisory Committee on the Census of Distribution which were held in Washington recently. I had the privilege of serving as chairman of the committee. Various thoughts were brought out which may be of interest now. Naturally, the views presented were merely tentative, since the project is still in too early a stage for definite recommendations. I will tell you, however, about some of the matters on which there seemed to be a "meeting of minds."

It was the consensus of the experts present that the Census of Distribution ought to be limited to the handling of commodities. In other words, it should be strictly a merchandising census. It had been suggested, at various times, that it might be advisable to ascertain the fact about the so-called "service industries"—such activities as those of bankers, insurance agents, realtors, security exchanges, and (in a different field) beauty parlors, barber shops, automobile service stations, and the like. It would appear, however, that it is not yet feasible to undertake so comprehensive an enumeration, and that it is better to concentrate on the task of obtaining the facts about what happens to actual merchandise as it passes from producer to consumer.

The Census of Distribution is to include both wholesale and retail establishments. As regards the distribution of "consumer goods" (that is, those ready for final consumption by the individual consumer, as against those destined for use by industries or for further processing), the census will probably omit commission agents, manufacturers' agents, and merchandising brokers. It is frankly recognized that the omission of firms in these latter classes is a deficiency which we should try to remedy in later censuses.

In taking the census of retail merchandising, two different schedules of questions will be employed, according to our present plans. The first will be a short form, which all retailers will be required to fill out. The second schedule, calling for the presentation of considerable detail as to the business transacted, will be submitted to the larger retailers. It must be borne in mind, in this connection, that about 10 to 15 per cent of the retail establishments account for something like 60 to 75 per cent of the retail business—so we feel that the value of this Merchandise-Distribution Census will not be seriously impaired by the fact that we cannot get absolutely complete details concerning the business of the smaller retailers. These smaller merchants will be requested to supply details, if they keep such records as will enable them to do so—but we know, from our experience in previous investigations, that a very large proportion of the retail merchants regrettably do not keep detailed records. Many of them can give, at best, only the broadest general facts about the conduct of their business.

Besides this study of the manner in which "consumer commodities" are handled, there is to be a census of industrial distribution, in which we shall endeavor to obtain the facts about manufacturers' purchases of raw materials, semi-manufactured articles, machinery and other equipment, and supplies for the maintenance of the plant. Since the data about these operations are in the possession of manufacturers, it is believed that they should be obtained, next year, in connection with the regular Census of Manufactures. With respect to such dealings there is a deplorable lack of information at the present time, and the facts to be brought out still undoubtedly prove extremely valuable and enlightening. They will illuminate many problems and conditions that are now shrouded in obscurity.

But the Census of Distribution will, none the less, bring together a vast array of "background material." These facts should help to clear up numerous points of uncertainty—to dispel many doubts and unravel many difficulties—to stimulate investigation and bring about reform along many lines. It should aid us tremendously in our commercial thinking. Through a study of the figures, business men will unquestionably recognize many things that had not previously occurred to them—and some of these are certain to be striking.

"Just what are some of these things?" I imagine you are asking. Getting right down to "brass tacks"—to the actual, immediate conditions that a merchant has to deal with in his effort to make a living—what helpful facts can we bring out in a census of distribution? Secretary Lamont has told of some outstanding ones. Let us look at a few others—for example, at some facts developed in the Louisville Grocery Survey.

That study showed that meat is indisputably the leading food item in the family budget. It appears that the expenditure for food, per capita, is about 44 cents a day. Of the money spent for food in 2972 retail outlets, meat represented more than 17 per cent, general groceries nearly 16, dairy and poultry products 11, canned and bottled goods 9 1/3, and bakery goods almost 7 per cent. Meals and lunches which were included in the tabulation accounted for 13 1/3 per cent of the total food expenditure. There you have specific figures that mean something to anybody in the grocery business—figures that will serve as guideposts for the successful conduct of his activities.

This limited census of distribution in Louisville indicates that for stores having sales of less than $25,000 annually, rent and similar factors loom up as a pretty important element from the standpoint of prices and profits. Rent, in those stores, accounts for from 3 per cent to more than 8 per cent of the expenses, whereas the corresponding figures for stores doing $25,000 worth of business, or more, ranged from 1.78 per cent down to 1.24 per cent. The lowest rent expense in proportion to sales is shown in stores having sales of from $75,000 to $100,000 annually. Here, again, are significant facts in the field of distribution—facts with a very vital bearing upon business success or failure.

The Department of Commerce has been conducting a national retail-credit survey, and a preliminary report of the results has recently appeared. It discloses the widespread employment of credit bureaus; the extensive use of finance

(*Continued on page* 64)

Some Things a Census of Distribution Can Do

"IT will supply a classified body of statistics on the number of retailers by different lines.

"It will show the volume of their business.

"It will include some classification of commodities sold.

"It will contain a beginning of knowledge of the volume of commodities sold through different groups.

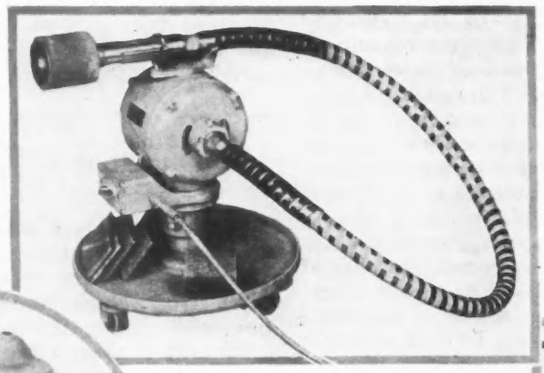
"It will provide more basic information for a manufacturer formulating sales quotas.

"It will give some comparison between one class of trade and another in different territories.

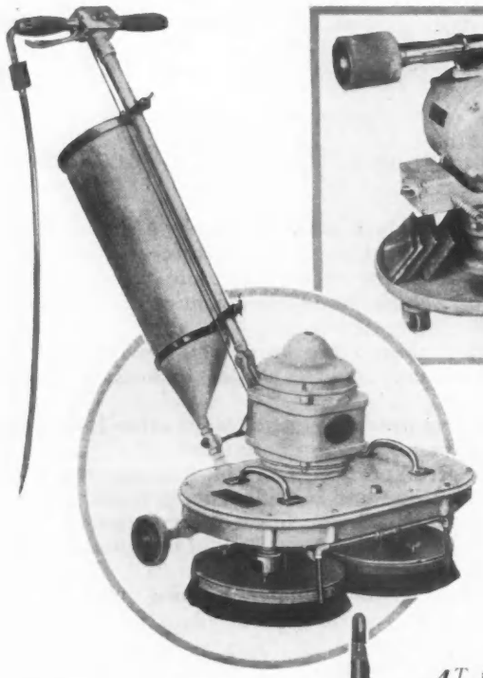
"It will contain some basic information for jobbers and retailers about the flow of commodities and the percentages they handle.

"It will start everybody thinking about sales costs."

Here is a Market for



AT the left is one type of portable electric surfacing machine that is mounted on casters and equipped with a fractional horsepower motor, control apparatus and an extension cord. It is used for many small surfacing and polishing operations

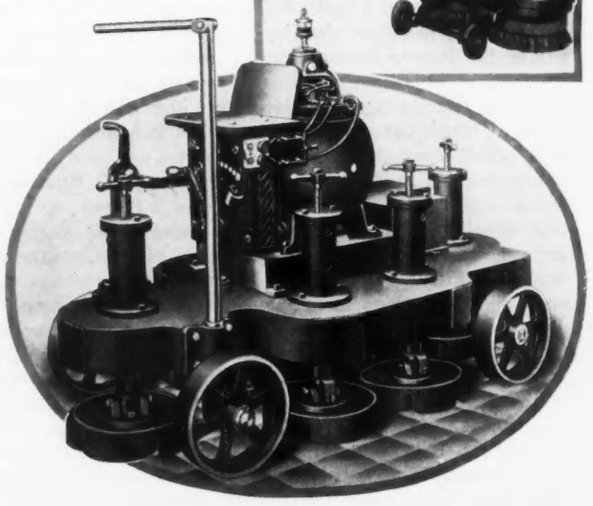


A FLOOR surfacing machine like that shown at the right might be used for scrubbing, waxing and polishing operations. These machines are built in three sizes and are equipped with fractional horsepower motors, control switch and about 25 feet of cord

DIRECTLY above is another type of twin-disk floor surfacing machine, fitted with a motor built into the top and a switch attached to the handle. This machine can be used for many surfacing jobs

AT the left below is still another type of surfacing machine in which the fractional horsepower motor is built integral with the base and above the wheel

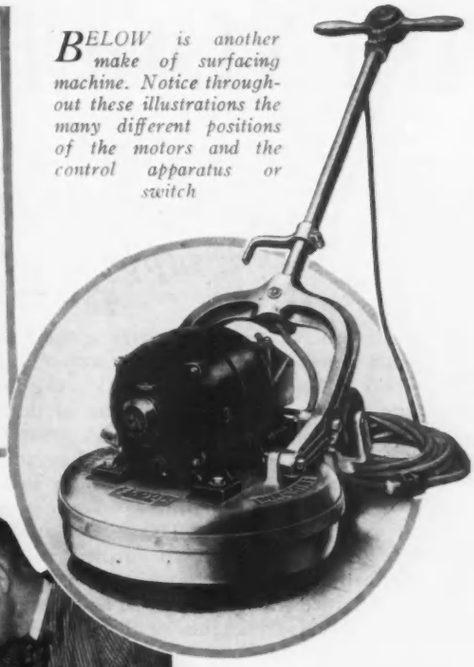
THE two illustrations at the bottom of the page show two commercial types of floor surfacing machines, both of which are equipped with motors larger than the others shown on this page. That at the left is used for sanding and the other on terrazzo

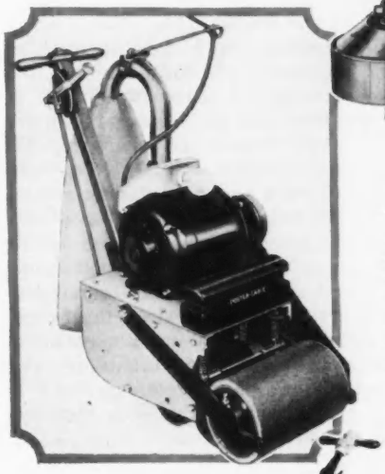


Electrical Equipment

AT the right is a scrubbing machine so constructed that the motor housing forms part of the top of the machine. In this case the control switch is mounted conveniently near the top of the double handle. It will be noticed that all of these various types of surfacing machines have in most instances as much as 20 or more feet of portable electric cord

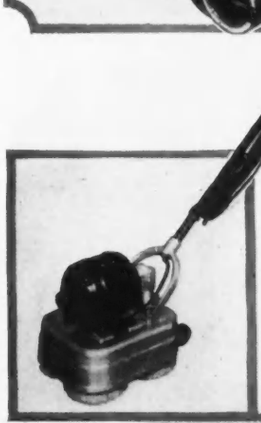
BELOW is another make of surfacing machine. Notice throughout these illustrations the many different positions of the motors and the control apparatus or switch



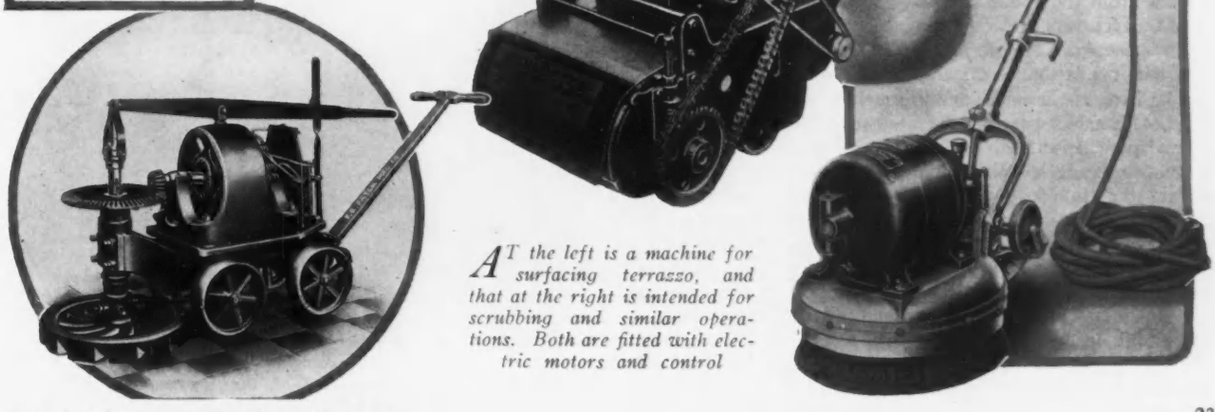


IN this type of sanding machine the motor is mounted as a separate unit on top of the machine, and the control is again on the handle. In addition to the motor and control on this device there is also the cord and an incandescant lamp

THE workman at the left is operating a small portable sander that is used for light work on stairs and in other similar places



AT the left is a floor polishing machine for household use. It is fitted with the usual motor mounted on the housing; a control on the handle, and the portable cord supplied with such devices



AT the left is a machine for surfacing terrazzo, and that at the right is intended for scrubbing and similar operations. Both are fitted with electric motors and control

Leagues Hear Plan for Manufacturer's Support

In conference at Camp Cooperation IX electrical league delegates listen to a proposed plan for the support of the league by manufacturers

ELECTRICAL league delegates in their eighth annual mid-summer conference at Camp Cooperation IX, held at Association Island, N. Y., Aug. 2-6, presented a picture replete with accomplishment in the direction of wiring promotion and market development, and heard R. Bourke Corcoran, president of the League Council, announce a plan for the establishment of a joint committee, comprising four members of the Council and three representatives of the National Electrical Manufacturers Association, to arrange the basis for financial support of league work by national manufacturers.

This committee will meet in June and December of each year. Requests from leagues to this committee for financial support from national manufacturers and other companies operating nationally are to be accompanied by information concerning:

Local need for the proposed activity or the market possibilities; details of the plans to conduct the activity; duration of activity; amount of money to be expended and division of budget for advertising publicity, field work or other purposes; population of city, number of residential, commercial and industrial meters; statement from central station executive that the central station will contribute not less than 50 per cent of the total budget; statement that actual overhead expense will not exceed 25 per cent of total expenditure for the activity; agreement by the applicant, at the time of application, to submit on request semi-annual progress reports to supporting manufacturers.

The committee will give careful consideration to all applications and in all cases of approval will return to the local league a certificate of approval, which may be used by the league in sending planograph or photostat copies to companies from which it is enlisting support. It is the intent that manufacturing companies make no contributions to leagues which do not secure a certificate of approval from the committee.

Manufacturers and others are not expected to give financial support to a league unless the league's proposed activities will result to the general benefit of the member.

The League Council committee which drew up this plan—C. C. Munroe, Electrical Extension Bureau of Detroit, J. E. North, Electrical League of Cleveland, and R. Bourke Corcoran—suggests that manufacturers when setting up advertising, publicity and sales promotion budgets include in one an amount representing a proper percentage of annual gross sales or a percentage of the advertising appropriation to be set aside as a league fund, and that this fund be divided among deserving leagues on the basis of the number of meters in each community being served by a successful league.

Total budgets of the leagues in 1928 amounted to $662,248. The manufacturers gave $66,019, central stations $338,320 and wholesalers and contractor-dealers $255,909. A survey made not long ago showed that only five manufacturers were contributing to more than one league.

The League Council committee which drew up the plan assumed that electrical manufacturers desired to see well organized local market development plans functioning in communities where population and the number of meters warrant such activity. Under the new plan the committee believes that manufacturers and others will be able to make contributions to leagues where a real market development work is being carried on and a desirable market is available.

The plan was designed to give the manufacturers intelligent, accurate information on the leagues they should support. It gives the League Council opportunity to rate the leagues on the basis of their activities, the strength of their local support and the opportunities of the market available. It will be necessary for each league to perfect its own organization in an efficient manner and to give concrete evidence to its own national organization that it is prepared

(*Continued on page* 64)

Among the many present at Camp Cooperation IX during the recent mid-summer meeting of the electrical league delegates were Harry B. Kirkland, camp manager (left), and S. L. Nicholson, acting vice-president of the Westinghouse Electric & Manufacturing Company (right)

Silver Solder—Its Uses in the Electrical Industry

No. 18 of a Series of Articles on Common Materials

Silver solders come in the form of strips, sheets, wires and filings and this material is used extensively in the electrical industry

By William Crawford Hirsch

SILVER leads all metals as a conductor of electricity, its conductivity being 57.226, whereas that of copper is 55.86. For that reason silver wire finds limited employment in fine instrument coils, especially when high conductivity must be paired with good resistance to corrosion, another outstanding property of the white metal. Silver finds use in contact points, frequently as an alloy with platinum and gold, as for instance in telephone contacts, and there are minor uses, such as in nitrate form in the silver coulometer. Nor must the metal's utilization as electroplating material be overlooked. It remained, however, for the development of silver as a highly useful agent in the joining of the ordinary metals of the electrical industry—a relatively recent accomplishment—to give it the status of a raw material or quantity consumption by the electrical manufacturer, and therefore of vital importance to him.

Silver solders are compositions, ranging in silver content from 80 per cent down to about 10 per cent. The higher the silver content, the greater the electrical conductivity as well as the resistance to heat, vibration, shock and corrosion. Malleability and strength also increase in proportion to the silver content. Melting point, a vital factor in determining the suitability of a solder for a given purpose as well as its economies, is also influenced by the silver content. Solders with a high silver content will flow freely at a temperature of 1325 deg. Fahr., while those containing lesser amounts of silver will require 1500 to 1600 deg. Fahr. They bridge the melting temperature gap between the lead-tin solders and the base metal hard solders which call for temperatures of from 1625 to 2100 deg. Fahr.

In an instrument manufacturing plant silver solder is used for brazing nickel rings to brass handles

Efficiency of silver solder is predicated to a considerable extent on the purity of the constituent metals and close control of the metallurgical process by which they are alloyed. Leading manufacturers emphasize in their sales literature that they exclude scrap silver just as they do scrap brass. The former is usually not overclean sterling silver which contains 7 1/2 per cent copper. They do not use scrap brass because the varying zinc content of high brass and of low brass, aside from frequently present impurities, yields a heterogeneous instead of homogeneous mass. Silver solder is annealed to prevent oxidizing. A quality silver solder on the market is the product of a refiner of precious metals who applies to the production of silver solder the same methods as to platinum alloys, weights being taken on troy scales in ounces and decimal parts of an ounce and no shipment being made without preliminary testing of a sample in the laboratory.

This close control makes available to the electrical manufacturer silver solder of definitely guaranteed composition and just as definitely and uniformly assured resistance value and fusing point.

The precautions taken by reputable producers to insure uniformity of quality of different grades of solder mean in effect a lowering of cost to the electrical consumer for the potential loss involved in making joints and connections with solders of variable resistance value is obvious. There is a mistaken impression abroad that because silver is classified among the precious metals its utilization for manufacturing purposes entails too high a cost. Silver, in addition to being a coinage metal, has a decidedly industrial character. Without it there would be no mirrors nor photographs. Neither amateur nor professional photographers seem to have any scruples of conscience in using it. Why? Because a little silver goes a long ways. This is also true of its use in solders. Frequently solders with a high silver content are used for purposes that could be much more efficiently and economically attained with low silver solders, and it is largely due to their misuse that the cost of silver solders is thought by many to be high. A thin film is all

Illustrations by courtesy of Handy & Harman.

that is necessary to make a strong, sound joint. Moreover, manufacturers recognize that one of the handicaps which they have to overcome is the notion that "silver solder is too expensive," and therefore are centering the research activities of their laboratory staffs on the development of solders with a minimum silver content. These give excellent satisfaction in the joining of heavy parts. In this group is one, working at 1500 deg. F., especially suited for brass and extruded brass. The colors of silver solder are brass-yellow, pale-yellow, yellow-white, and silver-white, the last named being the color of solders with a high silver content. Quite frequently matching of the color with that of the parts to be joined is desirable in a solder and is possible in many cases.

Different metals call for different solders. Solders with low melting points are indicated for copper. For splicing copper and wire cable, especially when the wire must stand the heavy strain of successive rolling and drawing operations, solders with the highest silver content are recommended by manufacturers. For brass low silver content solders are used, not only because of their economy but also because they are highly efficient for that purpose. Easy flow is especially required of solders used for nickel and Monel metal which melt only at high temperatures. Solders with a low silver content are used for iron and steel.

Silver solders, because of their melting heats, ranging from cherry red to bright red, require the use of some kind of torch, oxygen and gas or oxy-acetylene. The latter, however, is considered as too intense for some kinds of work. Borax, mixed with water to make a paste, in the form of a saturated solution, or powdered, is used as flux. Fused borax mixed with alcohol may also be used. The borax protects the metal from oxidation. Silver solder manufacturers recommend that borax be used liberally along the joints where the torch flame is applied and that the solder itself be covered with the flux.

Among electrical uses of silver solder are the welding of commutator segments; the soldering of leads or other joints subject to a rise in temperature above the critical point of soft solders; joining of bus bars, contactors, etc.; brazing of rotor bars and end connectors on polyphase induction motors; sealing of radio and X-ray bulbs; and the joining of lengths of copper wire in overhead and underground transmission lines, etc. One of the interesting uses of silver solder is in the splicing of so-called copper-weld wire, having a copper covering over its steel interior. The ferrous and non-ferrous components of the wire are joined at one operation with silver solder under an oxy-acetylene flame.

Government specifications make mandatory the use of silver solder in the electric leads and terminals of airplane equipment, this because of the resistance of silver solder to vibration. For the same reason silver solder is used to secure silicon-steel armatures to the steel springs of loud speakers the joints of which are exposed to a wide range of vibrations.

Silver solders find steadily growing employment in the manufacture of electrical refrigerators and other domestic appliances, such as heaters and toasters. A somewhat novel use for silver solder is in forming connections on an electric snow melting machine for keeping railway switches open in the winter. Such machines are used on the New York Central and other railroad lines. Their silver-brazed connections encounter rapid temperature changes from below zero to fairly high operating temperatures when the current is turned on for melting the snow.

Their relatively low melting points and free flowing properties together with their strength and resistance to high working temperatures have opened a large outlet for silver solders in brazing rotor bars to end rings in squirrel cage motors. Commutator bars on some types of motors are also silver brazed. The manufacturer of a leading brand of silver solder states that the joints made with his product have a tensile strength of 40,000 to 60,000 lb. per square inch.

Silver solders come in the form of sheet, strip, wire, and filed. Sheet comes in rolls, being furnished in any width desired. The standard thickness is 20 B. & S. gage. Strip comes in lengths of 20 in. and widths of from 1/8 to 3/4 in. and is supplied in large rolls or in brass boxes containing 1 oz. of solder. Wire is 1/16 in. in diameter and 18 B. & S. gage. The filed solder comes in 40, 60, 80, 100, and 150 mesh. Besides these standard sizes, manufacturers furnish special dimensions when the purpose to which the solder is to be put makes them more economical.

The price of silver solder is naturally subject to the fluctuations in the market for its component metals. Contrary to the general belief, the silver market, which is "made" in London, doesn't fluctuate any more sharply than that for other metals. The War brought about abnormal conditions, just as it did in all commodities, and these were aggravated in the silver market by the Pittman Act which fixed the price of the white metal at $1 an ounce. The silver market has fully recovered from the aftermath of this price-fixing, and price swings are no more pronounced than in the markets for other metals.

Nowhere is soldering a more important operation than in the joining of parts that, when assembled, are to give efficient electrical service. The solder must afford not merely mechanical strength, but protect and maintain the contacts and insulation. A loose joint heats up under current and the result may cause serious damage. Soldering offers many distinct problems. Silver solder manufacturers have accumulated much valuable knowledge regarding these, and electrical manufacturers will do well to avail themselves of it.

Another use for silver solder is shown in the illustration above, where the workman is assembling a radiator

Rod and Wire Forming Data and Methods

In the following, which is the second of a series of articles, the author gives considerable valuable information about forming rods and wires

By J. K. Olsen

Chief Draftsman, Stewart-Warner Speedometer Corp.

IN the previous examples and descriptions of plain, straight wire or rod stock parts, the blank length was found to be the length of part plus the width of cut-off tool (when used), and the only factors to be considered in estimating the raw material requirements were these simple items.

The previous examples and descriptions are important in consideration of various parts, such as gears, shafts, bushings and the multitude of other parts which are made from straight blanks; however, we now come to a series of bent parts and it will be necessary to consider more factors in obtaining the developed length of raw material blank.

In Analyzing a Part a Layout Should Be Made

FIGURE 2, shown in the first installment of this series, published in the August issue of Electrical Manufacturing, shows a part with a plain 90-deg. bend; this part was selected as an example due to its simple construction.

In analyzing this part in the regular manner, we find it a good policy to first make a plain and accurate layout as shown, due to the fact that the raw material item is of sufficient importance in all cases to warrant this precaution and the consistent, systematic use of this simple rule will aid in minimizing mistakes and unnecessary expense.

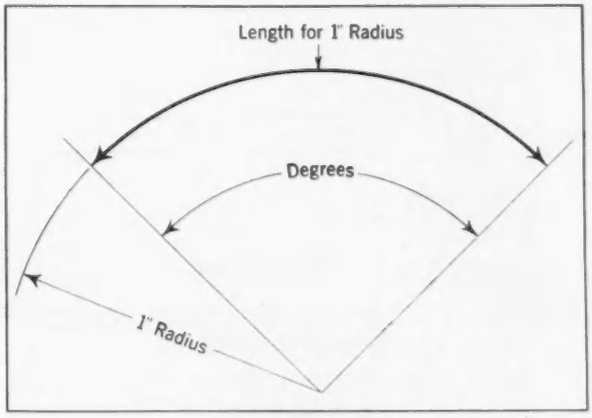


Figure 3

This diagram is the basis for determining the data contained in the table on the following page, Length of Circular Arcs (Radius=1). The table contains the lengths of arcs subtending angles of 0 deg. to 180 deg. and will be found very convenient in laying out blanks

As may be readily seen in the illustration, the part consists of a 90-deg. bend with a ⅛-in. radius and a ½-in. projection on each end. In other words, to find the developed length of raw material for this part, the length of the 90-deg. radial portion must be found, and as it is common practice to consider the bending point of round stock to be on the center line or ½ stock thickness, we find the required radius of the developed arc by adding the radius of the bend to ½ raw material thickness which in this particular case is equal to ⅛ plus 0.060 or 0.185 and by finding ¼ of the circumference of a circle with this 0.185 radius we obtain the required dimensions of the radial bend.

The length of the straight portions of the part is easily found and when added to the length of the radial part will give the desired developed length. However, the length of cut-off tool must be added to this length in case a cut-off tool is required.

In view of the fact that all parts do not have a 90-deg. angle bend, but may have any number of different angle bends, we are including a table which is generally used for finding the lengths of circular arcs and this table will be found very useful in figuring the developed lengths of bends or forms.

Formulæ for Determining the Weights of Rods and Wires

THE figuring of weights for this and following rods and wires is in accordance with the "Simplified Method of Figuring Weight of Rod Stock."

In the previous example no allowance for cut-off tool is made, the part being sheared off.

The ordinary method of figuring the blank for this part would be as follows:

$A = B - C$

$D = (C + \frac{1}{2} E) \times$ constant for Angle D

Transposing the above we have:

$A = 0.500 - 0.125 = 0.375$

$D = 0.185 \times 1.5708 = 0.2906$

The developed length is:

$2 \times A + D = 0.750 + 0.2906 = 1.0406$

The weight per 1000 pieces provided this part was made from steel would be:

$L \times W \times 87.5 = 1.0468 \times 0.03852 \times 87.5 = 3.528$ or 3.53 lbs. per 1000 pieces.

The following table gives the length of circular arcs to

the radius of one, for angles, minutes and seconds from 1 to 180 degrees.

To find the length of a circular arc with radius of 1 inch and an angle of 45 degrees, 30 minutes and 15 seconds. Opposite 45 degrees in the degree column find 0.7853982, opposite 30 minutes in the minute column find 0.0087266 and opposite 15 seconds in the seconds column find 0.0000727. Adding these together namely 0.7853982 + 0.0087266 + 0.0000727 equals 0.7941975 inch, length of arc.

For any other radius multiply the length of arc for 1 inch by the given radius.

Example:—If the radius equals 3 inches and the angle is 45 degrees, 30 minutes and 15 seconds, (the length of arc for 1 inch radius equals 0.7941975) the length of arc for 3 inch radius equals 3 times 0.7941975 or 2.3825925.

A Small Wire That Involves a Complicated Layout

IN Figure 4 is shown a typical small wire part which was chosen as an example of the large amount of development necessary to determine the blank length for parts of this class.

Lengths of Circular Arcs (Radius = 1)

Degrees						Minutes		Seconds	
0°	0.00000 00	60°	1.04719 76	120°	2.09439 51	0′	0.00000 00	0″	0.00000 00
1	0.01745 33	61	1.06465 08	121	2.11184 84	1	0.00029 09	1	0.00000 48
2	0.03490 66	62	1.08210 41	122	2.12930 17	2	0.00058 18	2	0.00000 97
3	0.05235 99	63	1.09955 74	123	2.14675 50	3	0.00087 27	3	0.00001 45
4	0.06981 32	64	1.11701 07	124	2.16420 83	4	0.00116 36	4	0.00001 94
5	0.08726 65	65	1.13446 40	125	2.18166 16	5	0.00145 44	5	0.00002 42
6	0.10471 98	66	1.15191 73	126	2.19911 49	6	0.00174 53	6	0.00002 91
7	0.12217 30	67	1.16937 06	127	2.21656 82	7	0.00203 62	7	0.00003 39
8	0.13962 63	68	1.18682 39	128	2.23402 14	8	0.00232 71	8	0.00003 88
9	0.15707 96	69	1.20427 72	129	2.25147 47	9	0.00261 80	9	0.00004 36
10	0.17453 29	70	1.22173 05	130	2.26892 80	10	0.00290 89	10	0.00004 85
11	0.19198 62	71	1.23918 38	131	2.28638 13	11	0.00319 98	11	0.00005 33
12	0.20943 95	72	1.25663 71	132	2.30383 46	12	0.00349 07	12	0.00005 82
13	0.22689 28	73	1.27409 04	133	2.32128 79	13	0.00378 15	13	0.00006 30
14	0.24434 61	74	1.29154 36	134	2.33874 12	14	0.00407 24	14	0.00006 79
15	0.26179 94	75	1.30899 69	135	2.35619 45	15	0.00436 33	15	0.00007 27
16	0.27925 27	76	1.32645 02	136	2.37364 78	16	0.00465 42	16	0.00007 76
17	0.29670 60	77	1.34390 35	137	2.39110 11	17	0.00494 51	17	0.00008 24
18	0.31415 93	78	1.36135 68	138	2.40855 44	18	0.00523 60	18	0.00008 73
19	0.33161 26	79	1.37881 01	139	2.42600 77	19	0.00552 69	19	0.00009 21
20	0.34906 59	80	1.39626 34	140	2.44346 10	20	0.00581 78	20	0.00009 79
21	0.36651 91	81	1.41371 67	141	2.46091 42	21	0.00610 87	21	0.00010 18
22	0.38397 24	82	1.43117 00	142	2.47836 75	22	0.00639 95	22	0.00010 67
23	0.40142 57	83	1.44862 33	143	2.49582 08	23	0.00669 04	23	0.00011 15
24	0.41887 90	84	1.46607 66	144	2.51327 41	24	0.00698 13	24	0.00011 64
25	0.43633 23	85	1.48352 99	145	2.53072 74	25	0.00727 22	25	0.00012 12
26	0.45378 56	86	1.50098 32	146	2.54818 07	26	0.00756 31	26	0.00012 61
27	0.47123 89	87	1.51843 64	147	2.56563 40	27	0.00785 40	27	0.00013 09
28	0.48869 22	88	1.53588 97	148	2.58308 73	28	0.00814 49	28	0.00013 57
29	0.50614 55	89	1.55334 30	149	2.60054 06	29	0.00843 58	29	0.00014 06
30	0.52359 88	90	1.57079 63	150	2.61799 39	30	0.00872 66	30	0.00014 54
31	0.54105 21	91	1.58824 96	151	2.63544 72	31	0.00901 75	31	0.00015 03
32	0.55850 54	92	1.60570 29	152	2.65290 05	32	0.00930 84	32	0.00015 51
33	0.57595 87	93	1.62315 62	153	2.67035 38	33	0.00959 93	33	0.00016 00
34	0.59341 19	94	1.64060 95	154	2.68780 70	34	0.00989 02	34	0.00016 48
35	0.61086 52	95	1.65806 28	155	2.70526 03	35	0.01018 11	35	0.00016 97
36	0.62831 85	96	1.67551 61	156	2.72271 36	36	0.01047 20	36	0.00017 45
37	0.64577 18	97	1.69296 94	157	2.74016 69	37	0.01076 29	37	0.00017 94
38	0.66322 51	98	1.71042 27	158	2.75762 02	38	0.01105 38	38	0.00018 42
39	0.68067 84	99	1.72787 60	159	2.77507 35	39	0.01134 46	39	0.00018 91
40	0.69813 17	100	1.74532 93	160	2.79252 68	40	0.01163 55	40	0.00019 39
41	0.71558 50	101	1.76278 25	161	2.80998 01	41	0.01192 64	41	0.00019 88
42	0.73303 83	102	1.78023 58	162	2.82743 34	42	0.01221 73	42	0.00020 36
43	0.75049 16	103	1.79768 91	163	2.84488 67	43	0.01250 82	43	0.00020 85
44	0.76794 49	104	1.81514 24	164	2.86234 00	44	0.01279 91	44	0.00021 33
45	0.78539 82	105	1.83259 57	165	2.87979 33	45	0.01309 00	45	0.00021 82
46	0.80285 15	106	1.85004 90	166	2.89724 66	46	0.01338 09	46	0.00022 30
47	0.82030 47	107	1.86750 23	167	2.91469 99	47	0.01367 17	47	0.00022 79
48	0.83775 80	108	1.88495 56	168	2.93215 31	48	0.01396 26	48	0.00023 27
49	0.85521 13	109	1.90240 89	169	2.94960 64	49	0.01425 35	49	0.00023 76
50	0.87266 46	110	1.91986 22	170	2.96705 97	50	0.01454 44	50	0.00024 24
51	0.89011 79	111	1.93731 55	171	2.98451 30	51	0.01483 53	51	0.00024 73
52	0.90757 12	112	1.95476 88	172	3.00196 63	52	0.01512 62	52	0.00025 21
53	0.92502 45	113	1.97222 21	173	3.01941 96	53	0.01541 71	53	0.00025 70
54	0.94247 78	114	1.98967 53	174	3.03687 29	54	0.01570 80	54	0.00026 18
55	0.95993 11	115	2.00712 86	175	3.05432 62	55	0.01599 89	55	0.00026 66
56	0.97738 44	116	2.02458 19	176	3.07177 95	56	0.01628 97	56	0.00027 15
57	0.99483 77	117	2.04203 52	177	3.08923 28	57	0.01658 06	57	0.00027 63
58	1.01229 10	118	2.05948 85	178	3.10668 61	58	0.01687 15	58	0.00028 12
59	1.02974 43	119	2.07694 18	179	3.12413 94	59	0.01716 24	59	0.00028 60
60	1.04719 76	120	2.09439 51	180	3.14159 27	60	0.01745 33	60	0.00029 09
	Degrees					Minutes		Seconds	

This table, as is explained in the text, provides a very simple method for finding the lengths of circular arcs when this information is needed to determine the developed length of a formed rod or wire

This part may be also taken as an example for the information of draftsmen and designers who should carefully consider the dimensioning of drawings in regard to raw-material length, as without doubt very little attention is given to the elimination of dimensions which complicate blank development.

In this particular design the dimension of the drawings are workable, however, as may be seen in the developing layout, a large number of additional dimensions must be obtained in order to find the length of blank required.

On layouts of this class it is common practice to use an even fraction or dimension for the final blank length and as there is generally some factor present that cannot be calculated, it is preferable to use the even number or even fraction which is next larger in size.

The diameter of the wire used in making this part is 3/32-in. which would indicate that a plain clipping operation would be sufficient to reduce the raw-material to the proper blank size, therefore, in figuring the weight per 1000, on blank multiple, etc., no cut-off allowance is used. The customary 5 per cent allowance for waste is of course added.

Formulæ for Finding the Developed Lengths of Formed Rods or Wires

THE developed length is obtained in the following manner:

$A = B - C$

$D = (C + \frac{1}{2} E) \times$ constant for angle D (120°)

$F = G + E + H - A$

$J = \dfrac{F}{\text{Cosine K (30°)}}$

$L = G + E + C$

$M = L - J$

$P = M \times$ cotangent N (30°)

$Q = (G + \frac{1}{2} E) \times$ constant for angle Q (30°)

$R = \sqrt{P^2 + M^2}$

$S = \sqrt{J^2 - F^2}$

$T = R + S + C$

$U = V - T$

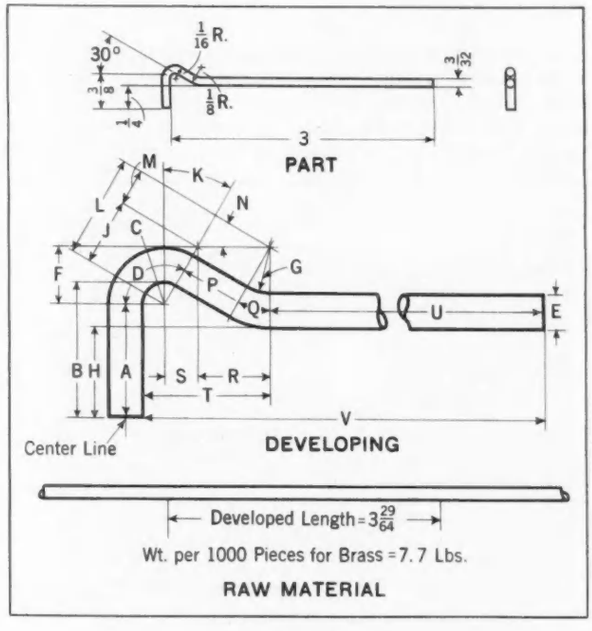


Figure 4

This is a simple hook made from a formed rod or wire, yet it involves some careful estimating to determine the exact amount of stock to make one piece. How it is done is explained in the accompanying article

Transposing in these formulæ we have:

$A = 0.375 - 0.0625 = 0.3125$
$D = (0.0625 + 0.0468) \times 2.0944 = 0.2289$
$F = 0.125 + 0.0937 + 0.250 - 0.3125 = 0.1562$
$J = 1562 \div 0.8660 = 0.1804$
$L = 0.125 + 0.0937 + 0.0625 = 0.2812$
$M = 0.2812 - 0.1804 = 0.1008$
$P = 0.1008 \times 1.7320 = 0.1746$
$Q = (0.125 + 0.0468) \times 0.5236 = 0.0899$
$R = \sqrt{1746^2 + 1008^2} = 0.2016$
$S = \sqrt{0.1804^2 - 0.1562^2} = 0.0902$
$T = 0.2016 + 0.0902 + 0.0625 = 0.3543$
$U = 3.00 - 0.3543 = 2.6457$

Developed length is:

$A + D + P + Q + U = 0.3125 + 0.2289 + 0.1746 + 0.0899 + 2.7082 = 3.4516$ or 3-29/64 in.

The weight per 1000 pieces of this part, providing it was made from brass would be $L \times W \times 87.5 = 3.453 \times 0.02548 \times 87.5 = 7.699$ or 7.7 lb. per 1000 pieces.

Problems in Finding the Developed Lengths of U-Shapes

FIGURE 5 shows a bent rod, or "U" shaped part similar to a hook bolt.

In most designs, parts of this type would be threaded on the ends which would necessitate a clean cutting off operation. In case the ends were not threaded, it would be found faster and cheaper to use a simple clip-off operation.

This part is made from plain round rod stock and the length of the blank is developed in the manner common to parts of this class. The developed length being obtained as follows:

$A = B - C$
$D = (C + \frac{1}{2} E) \times$ constant for angle D (180°)

Transposing the above we have:

$A = 2.000 - 0.500 = 1.500$
$D = 0.750 \times 3.1416 = 2.3562.$

Developed length is:

$2 \times A + D +$ cut-off tool $= 3.000 + 2.3562 + 0.0937 = 5.4499$ or 5-29/64 in.

The weight per 1000 pieces of this part, provided it was made from steel would be:

$L \times W \times 87.5 = 5.453 \times .6676 \times 87.5 = 318.5$ or 320 lb. per 1000 pieces.

In Figure 6 is shown a part which is made from rather heavy material and laid out without cutoff allowance. The cross section of this rectangular rod is 1-in. by ½-in. and this size would necessitate that the material be cut and formed while hot.

In a part of this kind, the length of the blank is generally found by a development process. The length of the center line of the material is the required length for the blank. The developed length is obtained in the following manner:

$A = D - C$
$B = (C + \frac{1}{2}T) \times$ constant for angle B. (180°)

Transposing the above we have:

$A = 1.625 - 0.5937 = 1.031$
$B = 0.8437 \times 3.1416 = 2.6506.$

The developed length is:

$2 \times A + B = 2.0625 + 2.6506 = 4.7131$ or 4-23/32 in.

In a material layout for a part of this kind, it will be found that the developed length of the part is in most cases slightly greater than required. It will also be found that another slight increase in length may be experienced, due to the tendency of the metal to stretch while being formed hot. This slight excess in length has both its good and bad effects; however, for practical purposes it is more desirable to have a small amount of stock left over than to run short before production is completed.

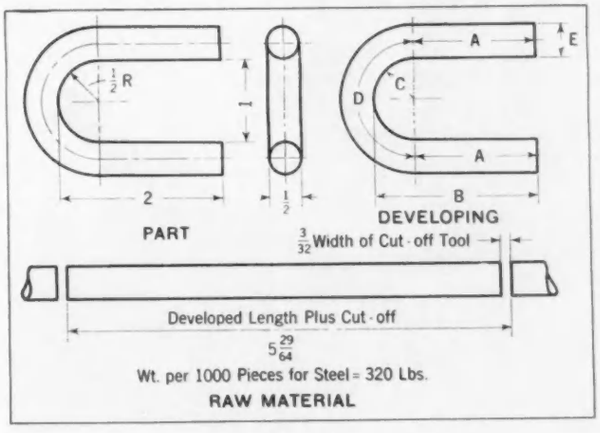


Figure 5

In finding the total length of stock required to make such a piece as that shown above, it is necessary first to find the length of a circular arc subtending an angle of 180 deg. and having a radius equal to that drawn through the center of the part

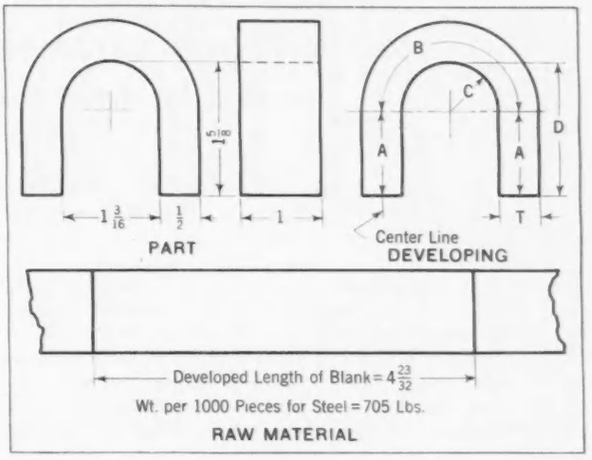


Figure 6

This part is very similar to that shown in Figure 5, except that it is made from heavier material, which makes necessary the use of still different methods for finding the total developed length

In a blank of this kind where the length is easily adjusted by a simple try-out, it is always desirable to use safe figures in estimating the raw material.

The previously mentioned method which determines the length of material by calculating the distance around the part at ½ of the thickness of stock, or in other words the center line of the part, will in all cases be a safe basis to use.

The weight per 1000 pieces of this part would be found by taking the area in square inches of one part and multiplying this by the weight of one square foot of the material used and multiplying the product of these factors by the constant, or 7.292. The resulting product would be the desired weight including a 5 per cent allowance for waste. The weight, providing the part were made of steel, would be $A \times W \times 7.292 = 4.7187 \times 20.4 \times 7.292 = 701.937$.

For the sake of convenience in estimating quantities accurately, the weight per 1000 pieces is generally expressed in even figures in weights of the foregoing amount. Therefore, the estimate would be 705 lb. per 1000 pieces.

(To be continued)

Some Recent Developments in

Circuit Breaker Construction

A description of a circuit breaker in which an arc is drawn in the conventional way by arcing contacts and then transferred to arc horns where it is removed by deionizing in a blow-in field

By J. E. McGee
Westinghouse Electric & Mfg. Company

CIRCUIT breakers used on A.C. systems may be divided into two general classes—those that depend on oil for their interrupting ability and those that do not. In the oilless circuit-breaker class, two types have been used for several years and a third has been developed recently. One of the types that has been used in the past is the carbon circuit breaker, the name being taken from the material used in the arcing contacts. The other is similar to a low-voltage contactor except that it is larger. Both of these types depend for their operation on lengthening the arc. This is done by separating the arcing contacts or moving the terminals of the arc along arc-horns until the voltage necessary to restrike it after the current passes through zero is greater than that available. Carbon circuit breakers are used in A.C. circuits up to 600 volts. Circuit breakers of the contactor type are seldom used in A.C. circuits of more than 2300 volts. However, a few have been made for somewhat higher voltages.

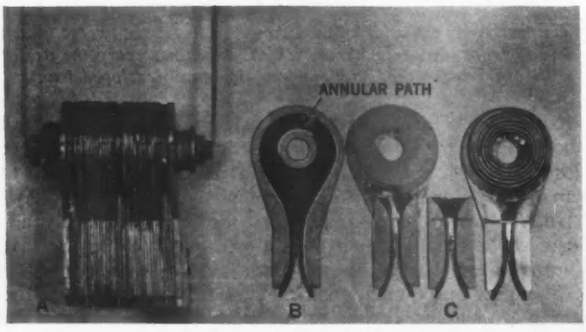


Figure 1
The deionizing structure of a "Deion" type circuit breaker, showing the arrangement of the different parts. A, is the radial field Coil; B, shows one plate with its insulation in place, and C is a view of the radial field coil

A third type of oilless circuit breakers has been developed recently and is known as the "Deion" circuit breaker. It operates on a principle entirely different from that of the two types mentioned previously, and requires less operating space than either of them, because the arc is drawn in a confined structure.

In the development of this circuit breaker tests were made to determine the rate of rise of voltage across a breaker immediately after the current was interrupted, i.e., the way in which the voltage changed from arc voltage to normal

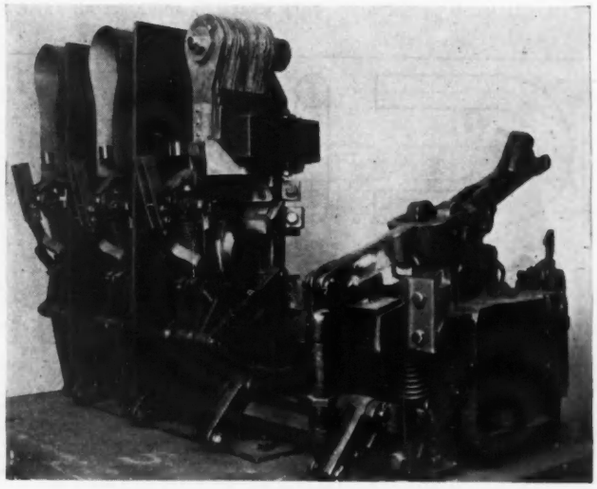


Figure 2
A 2500-volt "Deion" type circuit breaker showing some of the construction details and one section of the cover removed from one of the dionizing chambers

circuit voltage. Obviously a breaker must be able to withstand this voltage at all times in order to open the circuit. Therefore, these tests gave the rate at which the dielectric strength of the arc path must increase, immediately after the current is broken, to prevent reignition of the arc. Next, a means of obtaining this increase in dielectric strength was studied. The arc was made to play through a stack of metal screens so that, when the current reached zero, the conducting ions in the arc path could rapidly disappear by diffusing to the metal. After a long series of experiments it was discovered that neither terminal had to be at high temperature in order to maintain an arc. This was contrary to previous theory. As a result of this discovery, solid metal plates, which are called deionizing plates were used to replace the metal screens. Many tests were made on various types and shapes of deionizing plates in temporary structures to determine which was best from the standpoint of volts per inch of length of structure, and magnitude of current which could be interrupted.

To obtain further information, a practical circuit breaker embodying these ideas was constructed for 2500-volt service. This voltage rating was selected because the circuit breaker was small, and several test circuits were available. Therefore, experimental work could be carried on faster than with a higher voltage circuit breaker. The only circuit breakers of this size that have been made so far were used for experimental work and to obtain operating experience within the manufacturer's plant. No steps have yet been taken toward offering the 2500-volt "Deion" circuit breaker for general sale.

The theory of the "Deion" circuit breaker need not be discussed other than to state that it operates in the following manner: The arc is drawn in the conventional way by arcing contacts; then it is transferred to arc-horns and removed along them into the deionizing chamber by the magnetic blow-in field. As the arc enters the chamber it is broken into a multiplicity of short arcs, in series, by the deionizing plates, shown at A in Figure 1. The short arcs are kept moving around annular paths as indicated at B in Figure 1 and between the plates by a radial magnetic field to prevent burning of the metal. When the current reaches its periodic zero the air between the plates is changd from a conducting to an insulating state and the arcs are extinguished.

The change of condition in the air from conductor to insulator takes place in two ways. First, when the current tries to build up on the succeeding alternation the terminals of the shorts arcs are reversed in polarity and a very thin layer of gas, called a space charge sheath, forms next to the negative terminals or cathodes. Each of these sheaths require approximately 250 volts (crest value) to start an arc through it. At the same time that the sheath forms, the ions, which are the conductors in the air, begin to disappear by recombining with each other and diffusing to the grids. Therefore the voltage necessary to reignite the arc is 250 volts per gap the first instant (fraction of a microsecond) and increases with time.

The contruction of the 2500-volt "Deion" circuit breaker is similar to that of the 15,000-volt size. It consists essentially of three parts, the deionizing chamber comprised principally of the plate structure, the arc-drawing mechanism with the main contacts for carrying the load current,

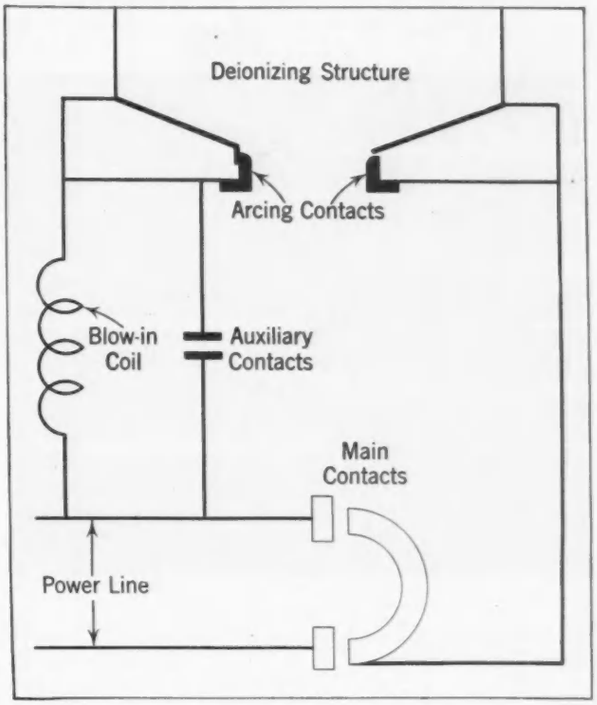


Figure 3

A diagrammatic arrangement of the electrical circuit of a 2500-volt "Deion" type circuit breaker, showing the blow-in coils, auxiliary contacts, arcing contacts, power line, main contacts and the dionizing structure

and the operating mechanism. Figure 2 is a picture of the assembled three-pole circuit breaker with the cover removed from one pole to show the deionizing chamber.

The deionizing chamber consists of a stack of copper plates 1/16 in. thick separated by insulating spacers 1/16 in. thick, with a radial-field coil interposed between the plates at the mid-point and at either end of the stack as shown at A in Figure 1. Figure 1 at B shows one of the plates with its insulation in place and C in Figure 1 shows the radial-field coil. The yoke completing the circuit for magnetic flux produced by the blow-in magnetic-field coil is located

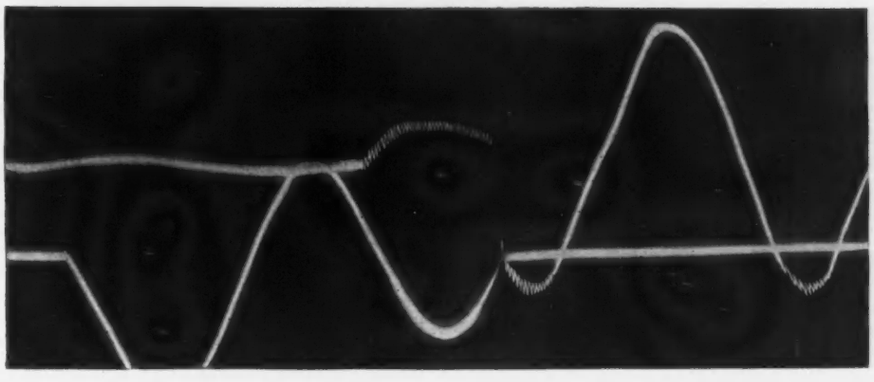


Figure 4

An oscillogram of 11,500 amperes at 2300 volts being interrupted by a 2500-volt "Deion" type circuit breaker. While the principles of deionization have been generally well known for a number of years, it is only recently that they have been successfully applied in circuit breaker construction for high voltages

on the outside at the lower end of the plate structure as may be seen in Figure 2. The coil producing this flux is on the yoke at the back. Figure 3 is a diagram of the electrical connections between the contacts and blow-in field coil. The sequence of opening of the contacts is, main contacts, auxiliary contacts and arcing contacts. The impedance of the blow-in field coil necessarily results in a difference of voltage between the coil terminals, and any contacts which short-circuit this coil must carry a low voltage arc on opening. Switching of the blow-in coils is performed by the

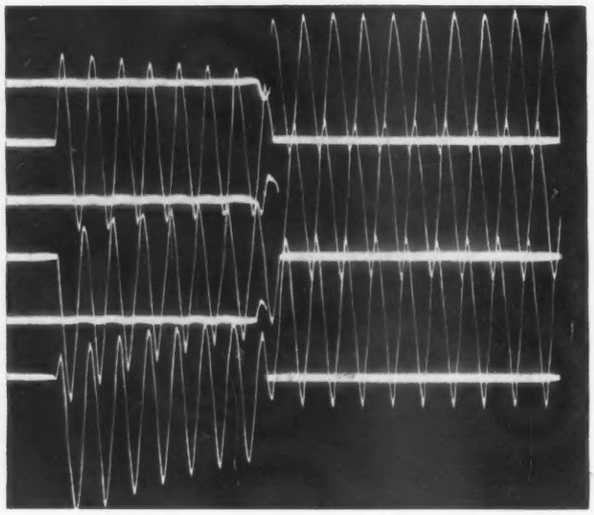


Figure 5

An Oscillogram of a 5400-volt, three-phase, 60-cycle, grounded neutral circuit being opened by a 2500-volt "Deion" type circuit breaker

auxiliary contacts and by this means, with the sequence of opening stated above, burning of the main contacts is prevented.

The electrical closing and tripping mechanism is of the conventional type used with oil circuit breakers and involves no special features as applied to the "Deion" breaker.

One of the important characteristics determined early in the investigation was the voltage per inch of length of grid structure at which the circuit breaker would operate. Neglecting the thickness of the radial-field coils, the theoretical value is 1400 volts, r.m.s. per inch. Since the thickness of these coils contributes to the total length of the grid structure, a more useful value is the total voltage interrupted, divided by the total length of grid structure, i.e., the average volts per inch that can be interrupted. After much experimental work a value of 700-volt r.m.s. was selected, which allows a very good factor of safety over the theoretical value. These limiting voltages are set to take care of the worst power-factor condition.

The maximum current available for test purposes at the laboratory where most of the development work was carried on, was 11,500 amperes at 2300 volts, single-phase, 60 cycles. This current was interrupted many times, requiring only one pole of the circuit breaker. Figure 4 shows a representative oscillogram of the circuit breaker opening this circuit.

Three-phase, 60-cycle tests were made on this experimental circuit breaker in another laboratory with loads varying from 2000 amperes at 1500 volts to 9200 amperes at 5400 volts and 7800 amperes at 6600 volts. Figure 5 shows an oscillogram of the circuit breaker interrupting the load of 9200 amperes at 5400 volts just mentioned. (All current and voltage values given in this paper are r.m.s. unless stated otherwise.) The machines supplying these loads were star-connected with grounded neutrals. Most of these tests were made at voltages above the rated voltage of the circuit breaker, which was 4300 vols for such a circuit (2500 volts from line to neutral).

Two of these circuit breakers were installed as back-up circuit breakers in test circuits, so that if the apparatus under test failed they would open the circuit. One was placed in a single phase, 60-cycle circuit where the maximum current might reach 3000 amperes at 2300 volts. During the last year and one half it has operated 1100 times and has had to interrupt the current on about 20 per cent of these operations. The other is being used in a three-phase, 60-cycle circuit where the maximum current might reach 3000 amperes and the usual current is less than 800 amperes. It has operated about 1000 times and has had to interrupt the current approximately 100 times since it was installed a year ago. Neither of these circuit breakers has required any attention.

Another of these circuit breakers has been used to open the primary circuit of a 500-kv testing transformer. In this circuit, the circuit breaker opens a low current, about 200 amperes, at various voltages from 2000 to 4000 volts, single-phase, 60 cycles. Two poles of the circuit breaker were put in series to allow for the higher voltage. This circuit breaker has operated more than 11,000 times in a year and one half without giving any trouble in the deionizing chamber, although a pin on the operating mechanism worked loose due to the large number of operations, necessitating repairs.

Figure 6 shows the fourth circuit breaker which is in the primary circuit of a large three-phase, 2300-volt, 60-cycle induction motor. It has opened the circuit approximately 2000 times in less than two years. The current was usually 700 amperes, but was sometimes as high as 1200 amperes.

The life of the deionizing chamber, is known to be extremely long although no definite limit has been determined. One deionizing chamber has been used for two years on various tests, operating over 2000 times at current ranging from 2000 to 11,500 amperes at 2300 volts. The latest series of tests made with this deionizing chamber consisted of 72 interruptions of 11,500 amperes at 2300 volts. As many as eighteen of these tests were made in one day. At the end of this series the deionizing chamber was inspected and found to be in good condition, although it had not been serviced during the tests. From this and other experiences mentioned it is evident that these circuit breakers will give many years of service and that they will require very little attention.

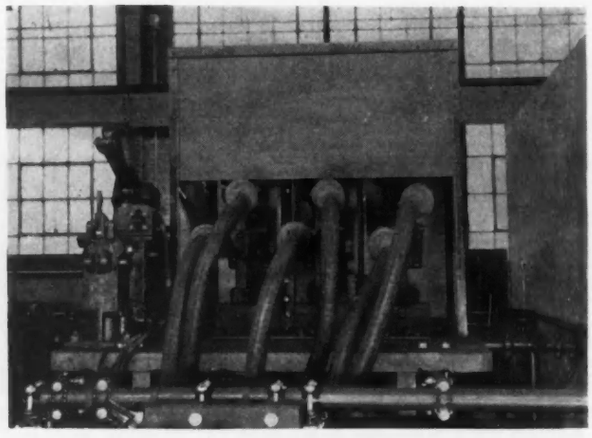


Figure 6

A view showing the installation of a 2500-volt "Deion" type circuit breaker in a 2300-volt motor circuit

Making an Essential Electrical Product

The Product

By WILLIAM W. BAXTER
Associate Editor, Electrical Manufacturing

PROBABLY no other piece of electrical apparatus plays any more important part in the electrical industry than do commutators. Essential to the proper functioning of generators, automotive starters and the majority of electric motors, other than the induction types, they might well be looked upon as one of the principal things that make possible the use of electricity as a source of power.

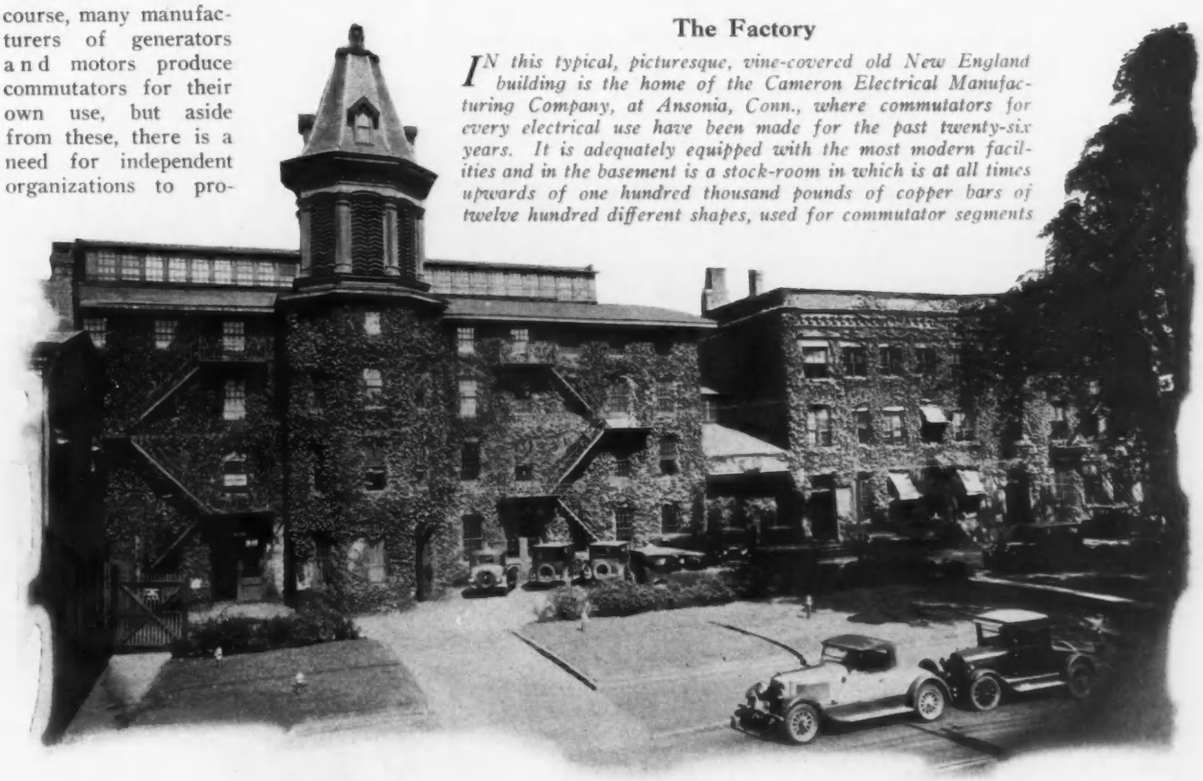
Because commutators are so necessary their production has grown to become one of the important branches of the electrical industry, and because of the demand for these devices, several organizations have been established to manufacture them. Of course, many manufacturers of generators and motors produce commutators for their own use, but aside from these, there is a need for independent organizations to produce commutators for special applications and replacement purposes.

It should be understood that the manufacture of commutators is a highly specialized industry, involving a most thorough understanding of the many methods of machining and finishing copper and steel, as well as first hand knowledge of the properties of insulation, its production and applications electrically.

Commutators, as is generally well known in the electrical industry, consist principally of a number of irregularly shaped copper bars, or segments of copper bars, separated from each other and a central core by adequate insulating materials, and formed into a circular shape. The inside and outside surfaces must be absolutely concentric and the device must be in perfect static balance.

The Factory

IN this typical, picturesque, vine-covered old New England building is the home of the Cameron Electrical Manufacturing Company, at Ansonia, Conn., where commutators for every electrical use have been made for the past twenty-six years. It is adequately equipped with the most modern facilities and in the basement is a stock-room in which is at all times upwards of one hundred thousand pounds of copper bars of twelve hundred different shapes, used for commutator segments

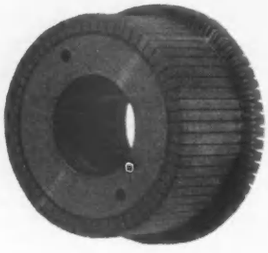


While the inside surface is usually cylindrical, to fit over a shaft, the outer surface may be made in many different irregular forms, to meet the requirements of special applications.

Usually the copper bars from which commutators are produced are in the shape of segments of a circle, the included angle between the two sides being determined by the number of divisions into which the circle is divided. These bars are cut to specific lengths and in many instances are finished in many irregularly shaped forms on their inner edges, to provide means for anchoring them to the inner core. This core is usually of steel, having an inner bore to fit a motor or generator shaft, and an irregularly shaped outer surface to retain the copper segments upon its surface. Between each of the segments, and between each of the segments and the core, there must be an insulating material of some kind.

Accuracy Is Essential

FREQUENTLY, because of some special application, other pieces of metal are attached to the outer ends of the commutator segments, to form electrical connections with other parts of the motors or generators for which the commutators are intended. The application of these pieces of metal for connections is often quite complicated, and they are at times welded, brazed, soldered or riveted in place.



THIS is but one of the many types of commutators manufactured by the Cameron Electrical Manufacturing Company, of Ansonia, Conn., but it will serve to illustrate the type of product made by this organization, now in existence for twenty-six years

Regardless of the form of the commutator the inner and outer surfaces must be bored and turned, positively concentric with each other, as has been explained. And, where either the inner or outer surfaces are irregular in shape, these various forms are produced by sawing the segments to the required shape by the use of hand saws and templates.

Therefore, as can be appreciated, to produce commutators of quality and in quantity requires an extensive complement of manufacturing facilities and a most comprehensive understanding of many different kinds of materials and manufacturing methods.

Realizing that the production of commutators was a highly specialized industry and that there was a need for independent producers of these devices H. P. Cameron founded in 1902, what is now the Cameron Electrical Manufacturing Company, of Ansonia, Conn. From a small organization this company has grown during the past twenty-six years until today it is recognized in the electrical industry as one of the leading organizations of its kind.

After a few years in business the original H. P. Cameron organization was taken over by a group of men, headed by John T. Kent, president and treasurer; John B. Davidson, vice-president, and John Elliott, secretary. Twenty-two years ago the new Cameron organization moved from the original small factory into the plant it now occupies, on Main Street in Ansonia, Conn.

From time to time there have been changes in the personnel of the organization, until today John B. Davidson is president and treasurer, Irving Whiting, vice-president; John Elliott, secretary, and George E. Andrews, general manager and assistant treasurer.

Mr. Davidson first came into the business of manufacturing commutators as mechanical engineer of the group that took over the original Cameron business. Later he was made vice-president and general manager, and in subsequent reorganizations became president and treasurer of the present company.

With a background of engineering and electrical training and at all times being in direct contact with all manufacturing operations, Mr. Davidson has seen his organization grow from a small factory employing some six or eight men and producing a small number of commutators a day to an institution of prominent importance in the industry, employing as many as 125 workmen and manufacturing upwards of 300,000 commutators annually.

Large Stock of Material on Hand

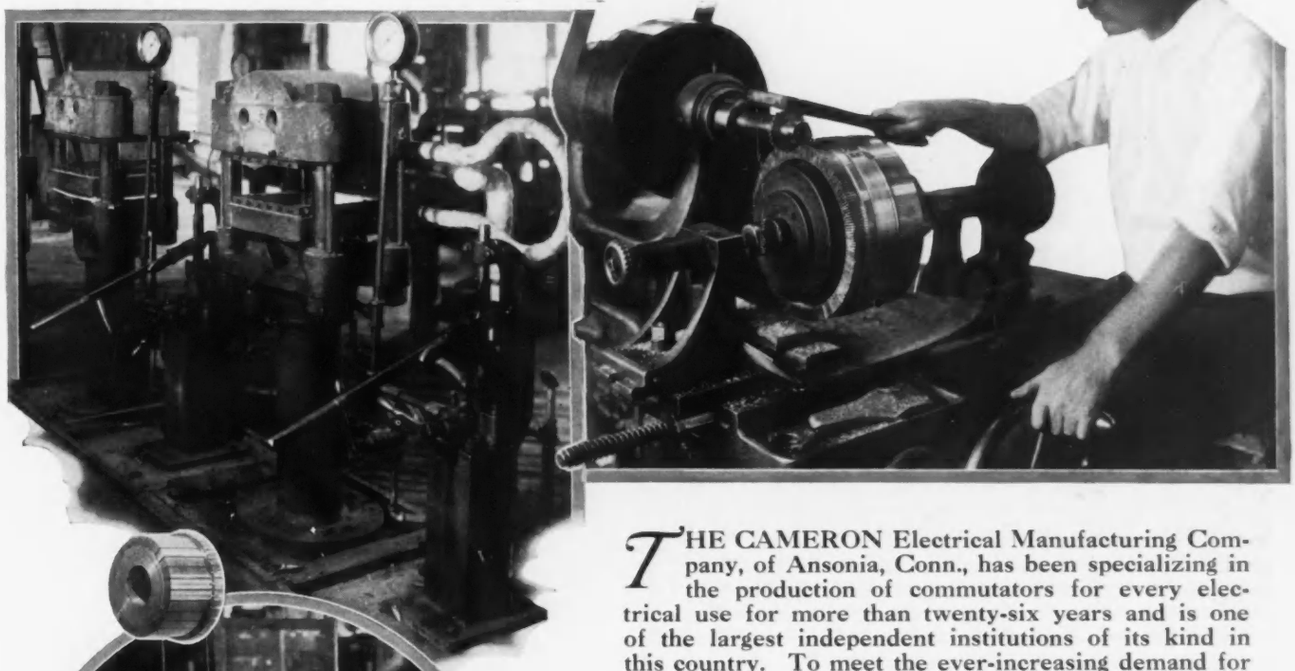
TO do this, Mr. Davidson points with pride to the fact that the business has been builded upon a reputation for quick, prompt service and quality products. This has only been possible because of the extensive facilities of the company and because it is a hard and fast rule of the Cameron Company that it always have on hand sufficient materials from which to supply any average demand for any kind or type of commutator.

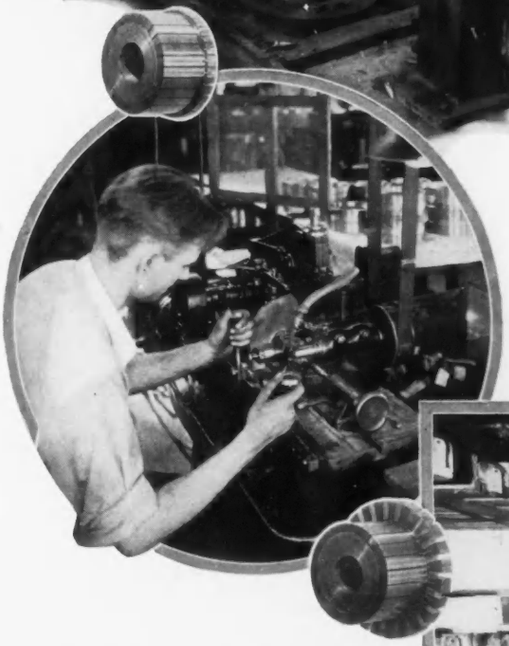
To make this possible there is always in stock, in the basement of the Cameron plant, more than 100,000 pounds of hard-drawn copper bars for segments, with the necessary steel for cores and sufficient insulating materials. One hundred thousand pounds of stock materials is no exceptionally large amount for a large factory to have on hand at all times, but it must be taken into consideration that included in these bars are 1,200 different shapes or sizes. This one policy of always having sufficient stock of the proper shape on hand is the significant reason why the

(*Continued on page* 64)

THE view at the right shows but a very small section of the motor repair department of the Cameron Electrical Manufacturing Company, at Ansonia, Conn. All of the motor repair work is incidental to that of manufacturing commutators, which is the principal product of the organization. Other motor repairs, such as coil winding, and the reconditioning of other motor parts is done in another section of the shop, as is explained in the article

Commutator Production

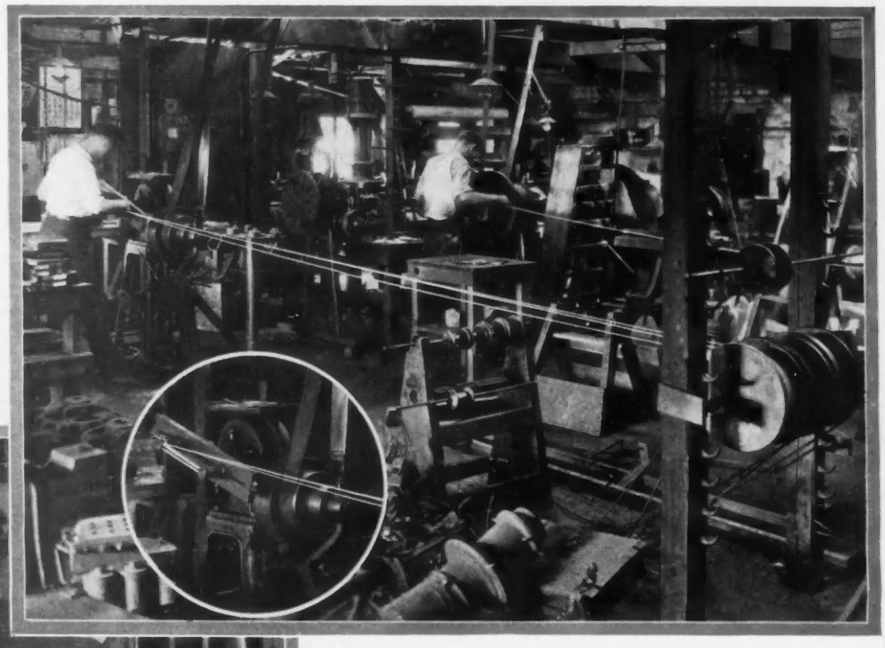




THE CAMERON Electrical Manufacturing Company, of Ansonia, Conn., has been specializing in the production of commutators for every electrical use for more than twenty-six years and is one of the largest independent institutions of its kind in this country. To meet the ever-increasing demand for these devices requires the use of the most modern facilities and an extensive assortment of all of the many different shapes of copper bars so necessary for the construction of the various types of commutators, such as are used on motors, generators, automobile starters and the like. Some of the facilities employed by the Cameron Company are illustrated on this and the three following pages.

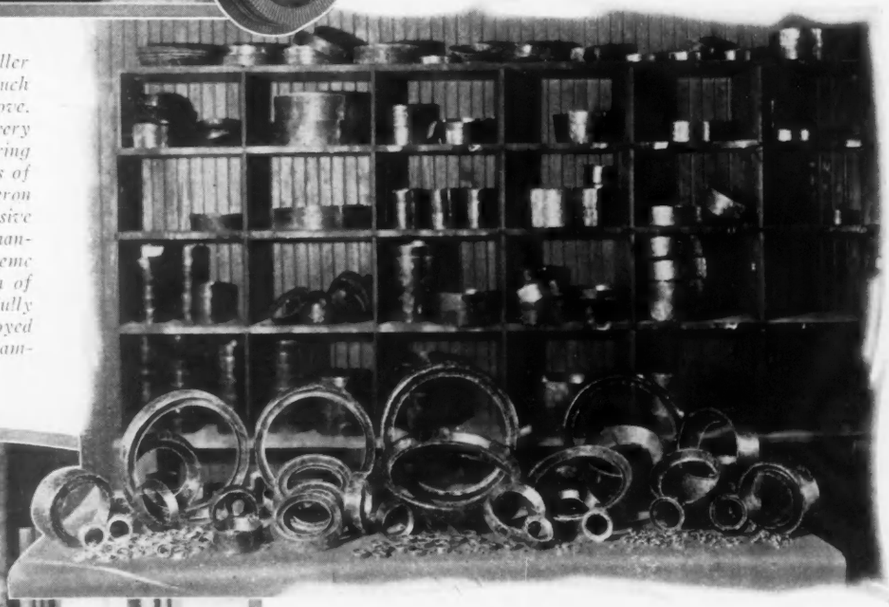
AT the right is only a small section of the stockroom of the Cameron Electrical Manufacturing Company, in which there are at all times more than one hundred thousand pounds of copper bars of some twelve hundred different shapes. All of this material the Cameron Company carries in stock for the sole purpose of being able to fill orders at all times with but a minimum of delay. Other illustrations on this page show some of the many different operations in the making of commutators

SINCE in the replacement of commutators on motors and generators there are at times other repairs to be made, the Cameron Company also has a department devoted to motor repair work. At the right is part of this section in which coils are wound. Other motor repair work is carried on in another section of the plant in a manner very similar to that employed in the conventional motor repair shop, although the facilities here are somewhat more extensive

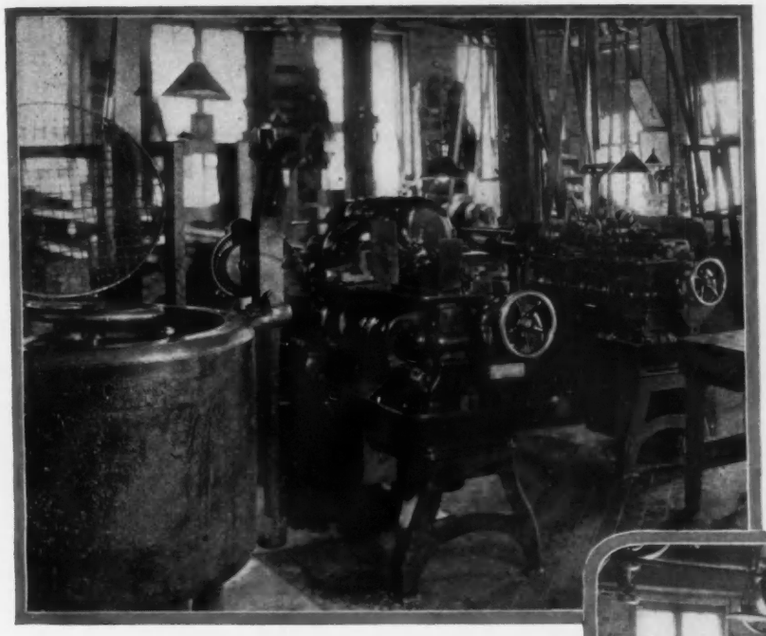


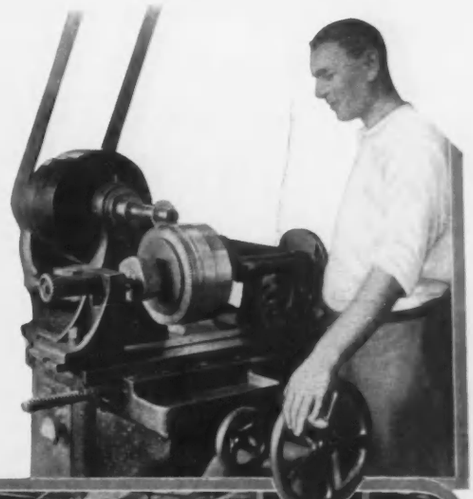
ONE of the essential features of good commutator construction is the use of the best in insulating materials. And as these are of many different shapes, it is necessary for the Cameron Company to be experts in the making of formed insulation for their various products. Below is an illustration of a rack containing but a few of the different types of insulation that it is necessary to make for commutators. Some of the equipment for making this insulation is shown on the preceding page

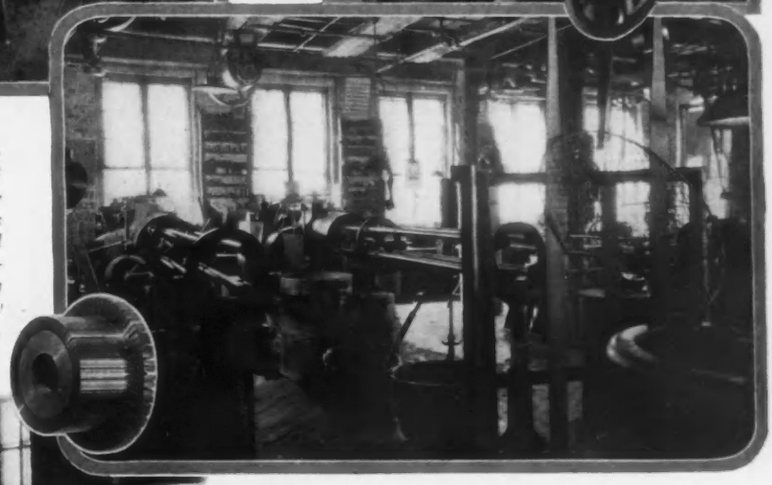
ALL machine operations on the smaller commutators are performed on such equipment as that shown in the view above. Here the operator is chucking a very small device in preparation for a boring operation. Since so many different sizes of commutators are produced by the Cameron Company, the work requires an extensive assortment of chucks and arbors or mandrels of many different sizes. Extreme accuracy is demanded in the production of commutators, and for this reason carefully made gages and micrometers are employed for all measurements, to insure that diameters are correct and concentric



AFTER the bars or segments and the strips of insulation for the smaller types of commutators are cut to proper length, they are transferred to that section of the shop shown at the left, where women operators assemble the many different pieces, to form a complete commutator. These small devices are held together with rubber bands or wires, according to their size and weight, after which they pass to the other departments of the plant for the necessary machining operations



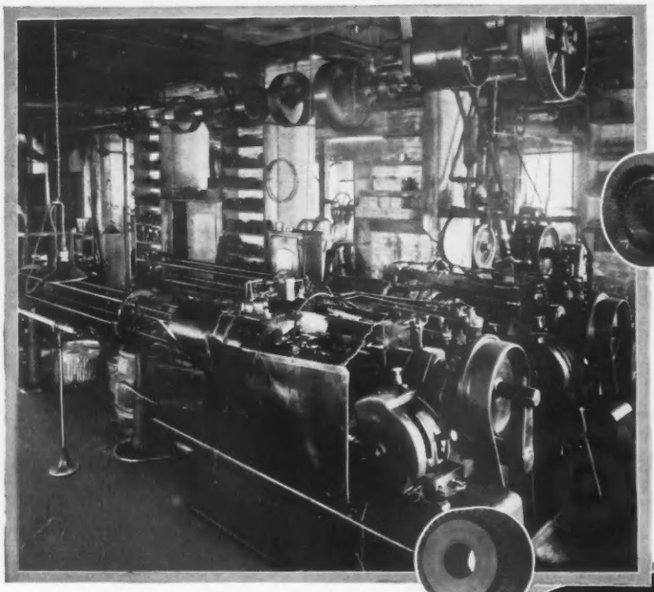


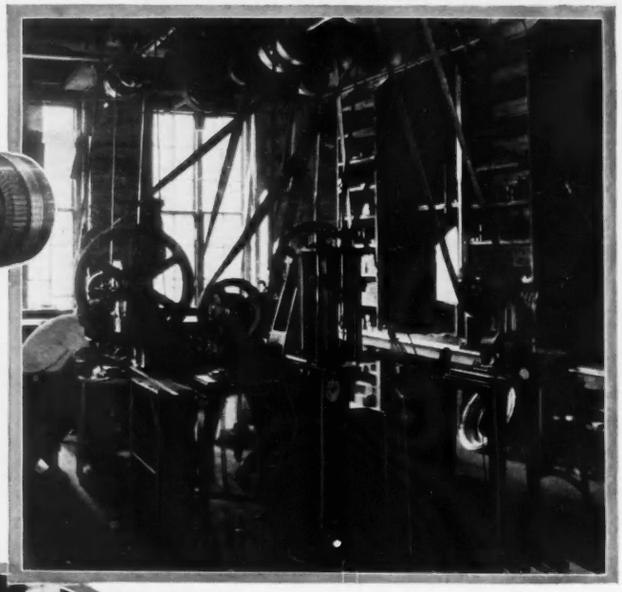


SCREW machines play an important part in the making of commutators, and a small section of this department in the Cameron plant is shown in the illustration above. At the left of this same view is a machine for extracting the cutting compound and oil from the chips. The workman in the upper right-hand corner of this page is shown milling the slots in one of the larger devices. Another view of the screw machine department is shown at the right

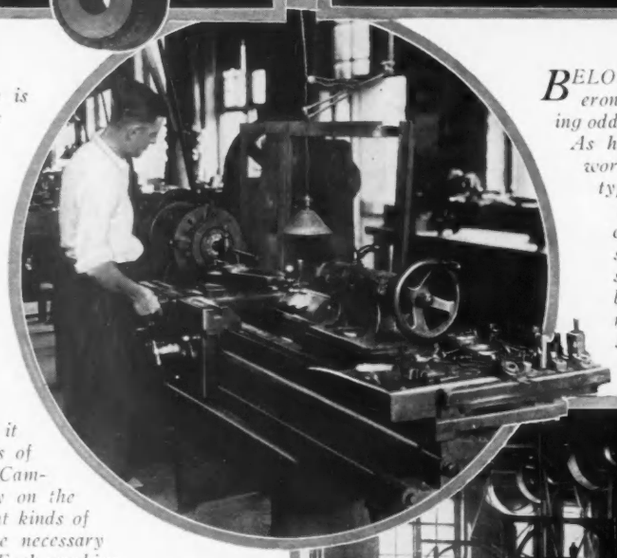
IN that section of the Cameron plant shown in the illustration below, the copper bars or commutator segments are cut to the various lengths required. All of this work is performed on the conventional types of cut-off saws, such as are used for similar operations in woodworking shops. For the shaping of the bars after they are cut into segments the common type of band saw is employed, such as illustrated on the following page

PRACTICALLY all of the boring and turning operations on the larger types of commutators is done in this section of the Cameron plant, on the heavy-duty lathes shown in the illustration above. This equipment is also employed for the finishing of all of the larger types of ground cores. As may be seen, practically all the machines are driven from overhead



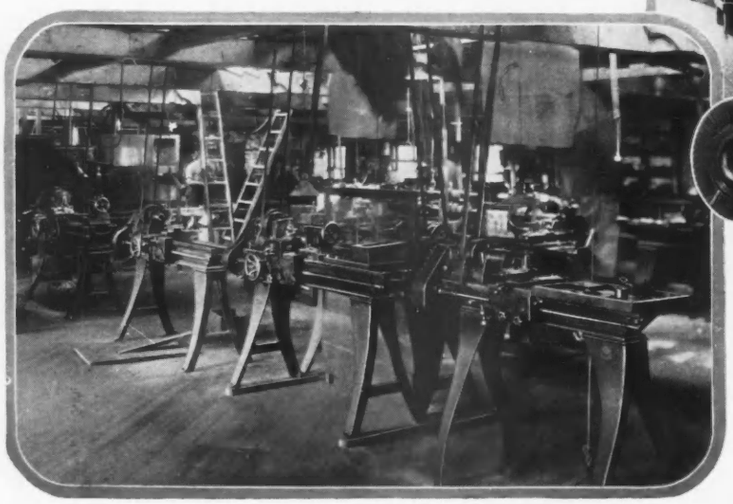


IN the illustration directly above is shown some of the heavier types of screw machines as they are used in the Cameron plant, while the view in the upper right-hand corner of this page shows some of the smaller punch presses in the shop. It will be noticed from all of the different illustrations that it is a general practice to arrange the machines in classes or groups



BELOW is that section of the Cameron plant in which segments having odd or irregular shapes are formed. As has been explained, all of this work is done on the conventional type of band saw. There is a large battery of these, as the amount of this work is extensive. Most of these irregular shapes are made by cutting the bars to proper length and then resawing them to required shapes with the use of templates

IN the circle in the center of this page is a view showing a typical set-up of an engine lathe as it is used for boring the smaller sizes of commutators manufactured by the Cameron Company. Notice in the tray on the lathe bed some of the many different kinds of tools and other equipment that are necessary for turning out work of this kind. Each machine is fitted with a full complement of all of the various tools and devices necessary for the work performed on that machine. This arrangement saves considerable time in production and insures full-time operation of the machine



AT the left is a general view of the small lathe department, showing the equipment used for making small commutators. Interspersed throughout the other illustrations on this and the three preceding pages, as inserts, will be seen but a few of the many different types of commutators the Cameron Electrical Manufacturing Company is called upon to produce. All of these are of the finest in workmanship and quality

Spray Finishing Fundamentals

By
PAUL W. COLLINS

This is the fourth installment of a series of articles in which spray finishing materials and equipment are described for refinishing purposes

IN THE previous installments of this series of articles, having to do with various materials and different types of equipment now in general use for spray finishing, the author explained how these materials and equipment were best used. In this installment he discusses the advantages to be had in refinishing repossessed or trade-in merchandise, and at the same time he explains what equipment should be provided for doing this kind of work.

Today's selling methods and the fact of this being a "buyer's market" almost forces one to have some type of finishing department in the service stations, sales branches or distributors establishments.

A marred or scratched finish frequently hampers a sale or causes the item to be sold for less than the published price when it could have been "touched up" and sprayed for a fraction of the discount which had to be made to dispose of a "shopworn article."

Refrigerators, radiators, radios, washing machines, lighting fixtures as well as automobiles are being "traded." The "trade-ins" must be made presentable for resale. The most thorough mechanical overhauling in the world is of little avail if the finish isn't bright and attractive. Automobile dealers found this out long ago and it has helped them to sell many used cars at prices otherwise unattainable.

Much electrical merchandise is sold "on approval." While a good percentage of these "test" sales stick, some of the merchandise somes back. Because the item doesn't suit one customer is no sign it is undesirable. It has to be cleaned up and in most instances refinished to look as good as new.

There is an increasing army of customers that want their new purchase to harmonize with its surroundings. Often this calls for a shade not included in the line, or the color selected is out of stock. Many manufactured products are finished in a standard color or shade and "toned" to meet the requirements of the patron. This results in increased stock turnover and better profits to all concerned.

Several enterprising sales organizations are having the service department refinish the article after its having been overhauled. The cost is small and can usually be added to the labor charge for overhauling. Its fresh appearance delights the customer and since it is appearance by which an article's condition is most frequently gaged, the service department's mechanical adjustments are given full credit and a customer's good will is assured.

Aside from the merchandise itself, the service department or store has many additional uses for such an outfit. The service and delivery truck can be kept in good appearance; salesmen's cars are frequently scratched up from traffic encounters or "accommodation delivery" and these places should be touched up. The display room, the store, the counter, the walls, window trims, office furniture and fixtures, everything about the place needs occasional dressing up. Such a gratifying appearance helps keep the potential customer's high regard for the merchandise and its source to him and ties in properly with the manufacturer's advertising which certainly tries to attract by neatness and clean cut display.

Until very recently, the cost of spray equipment for repairs and reconditioning paint work has been quite high. The air compressor manufacturers had not learned how to adapt their products to this particular field and it was not until the demand for such equipment made itself strongly felt that they began to realize the large field that existed

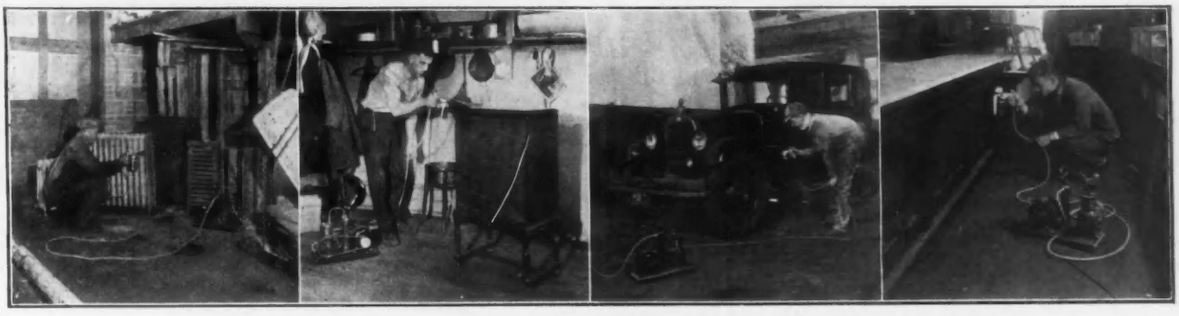


Figure 22

Here are shown four uses for spray finishing equipment. At the left a radiator is being repainted; next is a view showing how one dealer refinishes radio cabinets; adjacent to that, spray equipment is being used for touching up a salesman's car, and the fourth view shows how this method of finishing can be employed to refinish or touch up counters in the salesroom

(and the rapidity with which it was increasing) for small portable spray units. Today, there is available at prices ranging from under $50, equipment to do the same work that required an investment of no less than $150 only a year ago.

The principal questions asked relative to this type of equipment are:

1. How elaborately must such a refinishing shop be equipped, and how much floor space is required to do this work?
2. How large an investment does this call for?
3. What finishing materials should be used?
4. Is this work difficult to do and how does one go about doing it?

The answers are universally alike, varying only slightly with each particular item. The fact that more and more organizations are assisting their sales and service departments in this manner of favorably impressing their old customers and attracting new ones, proves the idea to be fundamentally sound and a paying investment.

Necessary Equipment and Floor Space.—The amount of equipment necessary in a repair or refinishing department depends, naturally, upon the volume of work to be done, the size of the articles, and the type of finish required. Much can be accomplished on a small investment. Let us take, for example, any typical sales and service station for washing machines, refrigerators, radiators, or some similar article. Such a store would naturally be on the ground floor, level with the street and would have an entrance from the rear as well as the front. The service and repair shop would be located in the rear section of the store.

The average service station having one or two men working on repairs would require no more equipment than shown in Figure 23. The floor space to do this spray work is negligible, as in most instances the article would be set up on a box or turntable in the doorway of the receiving room. The open door would be more than enough ventilation and, since the material sprayed would be quick drying (probably a lacquer) no special space need be reserved for the operation. In fact, the piece should be ready for the display room or delivery to the customer within 15 minutes or a half hour after the spray job is finished. Under this arrangement, there would be little or no requirement for special floor space. Even in winter, this plan can be worked with little or no inconvenience.

If the service shop is sufficiently large so that a man can be engaged (at least part time) for refinishing, one

Figure 23

AT the right is a portable spray finishing outfit such as could well be used by dealers for refinishing trade-in or repossessed merchandise. It is light in weight, and inexpensive.

should get a reasonably sized stationary outfit as shown in Figure 24. An outfit of this capacity (8 cu. ft. of air per minute) will do the work faster than a small portable and in turn calls for some floor space to be devoted to refinishing. An outfit of this nature would cost about $180 plus piping. The spraying could be done in front of a window into which an exhaust fan had been fitted, or a spray booth could be installed to meet the size requirements. The cost of a spray booth fitted with an exhaust fan would be approximately $130. An exhaust fan (should have 16 in. blades) for the window installation should cost between $30 and $45.

As to the spraying of trucks and touching up of salesmen's cars, etc., this may be done either in the garage, a shed, or out in the open, provided the sun is not beating down onto the surface.

A few years ago, the writer spent some time in the promotion of the practicability of spraying lacquer and "brushing" lacquer insofar as the layman and householder was concerned. During that period, many "Main Street" demonstrations were staged wherein the spraying of an automobile out alongside the curb was the main event of the day. "Brushing" lacquer was used primarily because it dried with more gloss than did regular spraying lacquer.

Figure 24

THIS is one of the smaller types of stationary spray finishing outfits. It, too, is comparatively inexpensive and requires but little room. It is particularly applicable to installations requiring slightly more capacity than that to be obtained from the outfit shown in Figure 23

Invariably, the results were satisfactory. The material drying as quickly as it did, picked up little or no dust from the street traffic and the outside temperature tended to hasten the drying time. Many people rented spray outfits from their local paint and lacquer dealer as a result of those demonstrations and very seldom was there a complaint. In fact, there is called to mind one dealer who had a long waiting list and finally had to buy a second machine for rental purposes.

This side light is merely given to stress the simplicity and quick acceptance of spray finishing in every walk of life. There were many housewives highly enthusiastic over spraying but, of course, the price ($200 at that time) precluded their investing in such equipment. At any rate, it proved beyond a doubt that spraying was not difficult and the average individual could do a passably good job with little or no practice.

The Investment Entailed.—From the paragraphs immediately preceding, one can safely say that between $50 and $400 would equip any refinishing department for the type of work described; and fully 85 per cent of the installations would be the lower priced outfits. Practically no instructions are required in using a small spray outfit. Since the guns used on small portables are slower in operation than those employed in production finishing lines, the chances of runs are greatly minimized. Some manufacturers of spray equipment furnish complete instructions as to the application of materials and refinishing methods with the guns and outfits. This makes it even easier for the beginner.

The Materials Used.—It is plainly evident that a quick drying coating material should be used. The essential requirements of the coating materials to be used are:

1. Good "covering" properties (so that only one coat is necessary).
2. Quick drying and still preserve the lasting quality of the material.
3. Natural gloss (so that little or no polishing is required).
4. A finish resistant to soap, grease and one not easily scratched or marred.
5. Durable finish that will stand at least 18 months' wear.

There are doubtless many good coating materials on the market that will meet these requirements. In many minds some type of "brushing" lacquer meets these requirements best. While the prefix "brushing" would imply that this material can be brushed on, there is some question as to

the ease of application and type of finish (especially obtainable on irregular surface, when applying this material with a hand brush, especially in refinishing work. All manufacturers of this type of material are agreed that it is excellent for spray finishing since it is, in a sense, regular spraying lacquer "retarded" so as to dry a bit more slowly and so as to not react so forceably to a speck of grease or an oil base undercoating.

The reason for suggesting this type of material is that most surfaces that are refinished have had either some oil or grease or soapy water splashed onto and rubbed into the finish while out in service, or (as in the case of a radio cabinet and similar furniture), the housewife has industriously applied furniture polish to the finish. Regular lacquer seldom holds to surfaces so contaminated.

While practically all the refinishing work that will be done will be confined to the color or top coatings, occasionally a coat of surfacer or a touch of spot-glazing will be required. In the main, however, the manufacturer can have his service dealers or branch offices supplied with quart or gallon containers of finishing materials in the standard colors of the product. A large stock need not be carried, and the investment will be small.

Instructions for the Use of Spray Painting for Refinishing

REFINISHING PROCESS.—If one were to go through a sheaf of miscellaneous instruction manuals, the following highlights would be evident.

"Dismantle the article as if for repair, remove all accessory parts (panels, plates, knobs, etc.), so as to present a surface as free as possible from irregularities.

"If the old finish is of oil base material (but not baked enamel) sand it down with plenty of clean water and No. 240 waterproof sandpaper making sure that the surface of the old finish is thoroughly cleaned of 'dead' material, oil, grease, polish, or soapy solution, and that the surface is smooth and free from deep scratches. Deep scratches will have to be spot glazed with a putty knife and sanded smooth when dry (about four hours). Dry the surface well, making sure that there is no water remaining in any cracks or crevices of the article being refinished and wipe off with a clean lintless cloth. Spray on a light coat of lacquer sealer and let stand for 15 minutes. Then spray on two light coats (about 10 minutes apart) of the desired color (using some lacquer base material).

"If the old finish is of lacquer or baked enamel, sand it down to smoothness with No. 240 waterproof sandpaper and clean, high-test gasoline. When the old surface has been sanded smooth and devoid of all 'dead' material, oil, grease, furniture polish, etc., wash it off clean with plenty of clean water and a clean cloth or chamois. Then dry thoroughly taking care that no water is left in any cracks, seams, etc. When dry (if the surface was lacquer) spray on one or two light coats of retarder thinner and follow this immediately with two medium coats of the desired color (using some lacquer base material). If the surface was of baked enamel, follow the foregoing instructions, except that the two coats of retarder thinner may be omitted."

If the material sprayed is naturally glossy and a high polish is not needed, the above is all that is necessary excepting the spraying of the "extras" that have been removed. These extras are usually either of Bakelite or Etched Metal and seldom to be done over unless much worn at which times it is best to replace them outright.

If the piece has a "shaded" or "toned" finish, the ground or finishing coat of the desired color is first applied. The toning color is reduced in body more than the finishing color was. The toning color should be sprayed on with the gun held at an even distance (about 12 inches) from the work and the spray directed at an angle from the edge inward. If the finish isn't quite smooth enough, coat the surface with a light spray of clear brushing lacquer thinned about two parts thinner to one part brushing lacquer. This will blend the toning color into the ground color and leave a desirably smooth and glossy surface. If the toning is done with bronze or aluminum powders, the bronze used should measure a scant ounce of powder to a pint of liquid thinned for spraying.

If it is a two or multi-color job, the main color should be sprayed on first. After this portion of the job is fully coated and dry (about two hours), it should be "masked" off with masking tape and paper drawn to the desired color line (which is usually located on the molding or seam). The other color is then sprayed on. After this second color is dry, the tape is removed, care being taken that no material is pulled up with it. The whole surface may then be sprayed with a light coat of clear lacquer well thinned.

"Crackle" or "Crystallized" Finishes—If the original finish is of this type and it is desired to give the new coating a similar appearance, the old surface should be washed thoroughly clean with high-test gasoline and lightly sanded with No. 240 waterproof sandpaper and clean water. Dry the surface well, being sure that there is no water remaining in depressions, cracks, etc. Spray on two light coats of retarder thinner.

If Crackle Finish: Spray on two light coats of background color permitting it to dry thoroughly. Some spraymen then apply a coat of clear lacquer next but this is not necessary if the undercoat material is naturally glossy. When the surface is dry, spray on one coat of crackle lacquer. The heavier the coat, the larger the cracks will be. Coat this with one or two applications of clear lacquer.

If Crystallize Finish: Spray on the crystallizing lacquer. Some makes of these materials are naturally glossy. others require a coat of clear lacquer over the top.

Spray Finishing Equipment Finds Many Uses in Small Shops

THESE processes are for spraying lacquers or brushing lacquers. If oil base materials are used, the standing and spraying operations are the same but the time allowed for drying between coats would have to be increased.

The list of "Cautions" should include:

"Do not spray light-colored materials over Red, Mulberry, Maroon, Cherry, Light Greens, Analine Blues, etc., as these colors will in most probability 'bleed' through and splotch the new coating. If it is necessary to try to do this, best results may be had by first spraying an intermediate coat or two of aluminum bronze powder or black or both."

It is evident from the foregoing that the spray method in the small shop is virtually the same as in the production shop. It is not difficult work and it is often found to be true that the apprentice boy in the shop lends himself more readily and willingly to the task than do some of the mechanics. The boy considers it a promotion and takes the work more seriously. This tends to lessen the refinishing labor costs still more.

There is little wonder that enterprising manufacturers are availing themselves of this inexpensive, yet very helpful method of solving part of their sales and service problems. Some manufacturers are suggesting the purchase of such machines; others are helping their service departments pool their purchase of these machines; and still others, out of their own enthusiasm, contract for a quantity of outfits suited to the particular refinishing requirements of their merchandise and thus assure themselves and their service departments of correct and proper equipment at a uniform cost.

SHOULD ADVERTISING

He Says *Yes!*

THE letter abstracted below, written by an advertising man, criticizes Phyllis Krafft Dunning for what she said in the June issue of ELECTRICAL MANUFACTURING *about advertising intended to introduce electrical appliances and similar devices into the home*

MODERN business men would welcome any invention that would permit them to get finished by three o'clock the work that now takes all day. If Phyllis will check up she will find that the business day is getting shorter and shorter. She will find that the business week is doing likewise. Gone are the days when a general store opened at six in the morning and stayed open until the last argufying cracker eater left for bed. She will find city stores that used to open at eight in the morning and close at six at night, except Saturday nights, now open at nine in the morning and close at 5.30 and Saturday at noon, and there is a movement on foot to get them to close all day Saturday, because it hardly pays to just get started on Saturday mornings and then close up again at noon.

I agree with her that a woman's place is in the home and in the home she is happiest and does not consider as a general thing that housework is drudgery. . . . Phyllis should make the acquaintance of the word "monotonous."

A woman's most tedious and monotonous efforts have the uncanny knack of not showing up very much as "Creations." And women, average women, want to be creators. The average woman is—and it shows instantly when she has created a child—something tangible to show for the monotony of bearing and carrying it and the labor and effort. She gets a modicum of the same "kick" when she creates a cake that shows. Or any of the hundred and one things a woman likes to do that SHOW. But washing clothes and dishes, making beds, mopping floors, etc., are things that don't SHOW. They are not creations and are therefore monotonous and tedious.

"WHEN you find a woman who isn't a martyr in her mind and heart, she is married to some half-baked softy who should be wearing corsets. I just can't agree with Phyllis that the big difficulty a manufacturer is up against in making women want labor-saving devices is to uproot a lot of inherited instincts."

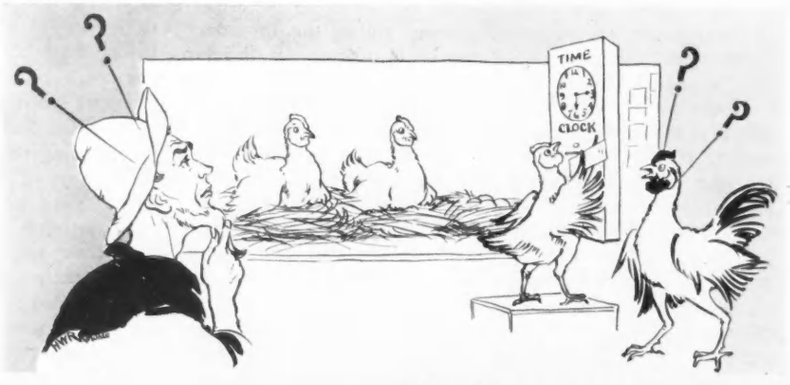
—R. S. W.

The vast majority of women who make sacrifices to obtain labor-saving devices, do not live around the corner from a delicatessen store even if they were inclined to patronize one often. Nor do the vast majority of women trot their families to tea rooms for dollar dinners. The three or four dollars thus expended will make a fair deposit on something the woman wants in her own home and she thinks twice before squandering a dollar.

Admitting that Phyllis is right about woman's innate tendencies to put up a front of martyrdom before their men folks, what manner of man would want to live with a woman who didn't? When you find a woman who isn't a martyr in her mind and heart, she is married to some half-baked softy that should be wearing corsets. I just can't entirely agree with Phyllis that the big difficulty a manufacturer is up against in making women want labor-saving devices is to uproot a lot of inherited instincts. The modern woman has none too much time because life is more intricate, there are more and better things to claim their time and attention than her pioneer ancestresses had to contemplate, and we men don't want them all frazzled out and have to live with them and we don't want them "too wise" like Phyllis, and we don't want them to nag and complain in order to get things, but we want them to work the martyr stuff cleverly and thus make it easy for us to play the big "butter and egg" guy. I'll trust that women as a body, know their stuff in all keys and a lot of them know it as well as Phyllis.—*R. S. W.*

What Is a Hen's Time Worth Anyway?

YOUR offer to save a woman's time is like the reply of the farmer to whom a salesman tried to sell an incubator on the basis that it would hatch chickens four days faster than a hen—"What's a hen's time worth anyway?"



Appeal to Woman's Martyrdom? She Says No!

IT is the contention of the author of this article, and another that appeared in the June issue of ELECTRICAL MANUFACTURING, *that electrical manufacturers should not direct advertising about household appliances to the martyrdom of woman. An advertising man does not agree with Phyllis in this*

By
Phyllis Krafft Dunning

IF you think, R. S. W., that I overshot myself, when I said advertising that appealed to woman's martyrdom was misdirected, I think you've neglected to load your guns at all! With which tactful statement I shall proceed to tell you why, point by point. Not, you understand I hope, in a spirit of personal unpleasantness, but because your diatribe illustrates so perfectly the mental attitude of many another misguided male who is misspending advertising appropriations.

TO prove her statements that women are martyrs, and like to be martyrs, Phyllis backs her argument with a mass of interesting data obtained from the report of a survey on "Home Conditions and Use of Labor-Saving Devices," prepared for the New England Division of the National Electric Light Association
—The Editor.

You made your big point when you said that a movement is on foot to close stores all day Saturday because "it hardly pays" to keep them open. That movement has become a summertime actuality in many places because it positively doesn't pay. In business and in life we all do what it pays us to do, or what we think it will pay us to do, whether we collect the payment in money, in gratitude, in spiritual satisfaction or in some other form. Some persons think it pays to be honest and faithful and diligent and reliable. Others think it pays to be cheats and thieves and liars and fly-by-nights. Some think it pays to conduct a business and make money—others that it pays to go in for religion and save souls. We all do what we are temperamentally, instinctively and intellectually constituted to believe "will pay." And women will buy electric equipment when, as and if we can convince them that it pays.

Surely modern business men would welcome any invention that would permit them to get through their work at three p. m. It would pay them dividends in free time. But I'm a howling dervish if I think they would spend any money to purchase such a device for their employees unless it could be definitely proved that it would pay them to do it. They would either cut down the payroll or put the workers on other jobs to finish out the day. You can be sure that anything that the captains of industry may do or buy is so done or bought because the doing or buying is calculated to make money or to save money—because it pays. If, as a secondary outcome, the doings and

Modern Amusements Have Changed Home Life

WITH radios, moving pictures, and fast automobiles the playthings of the millions today, who wants to hang around an airtight stove any more?

buyings make life easier or pleasanter for the employees—swell! But it's a secondary consideration just the same. So with domestic machinery. The ladies will buy first because it pays and incidentally because it makes life easier and pleasanter.

Woman Values Her Time at Nothing

TO get itself installed in a factory a machine must represent a definite improvement over existing methods—an improvement that will be reflected eventually in increased dividends. To get itself installed in the home a machine must convince the ladies that it can do a given job better and quicker, and will reflect dividends, not necessarily (please note that not necessarily) in money, but in health, comfort or some other desirable thing. The salesman's life will be made easier, however, if monetary returns can be shown.

And here's where our martyr complex rears its ugly head again. Being a martyr, to save money is the most pernicious and prevalent of all forms of martyrdom. A pile of clothes washed by hand and ironed with a flat iron represents so many dollars and cents saved. That it represents a stupendous loss in terms of wasted time and strength does not seem to occur to the woman at all.

The average woman values her time at nothing and whatever task she can accomplish with that time, at whatever cost to herself, is so much money in her pocket. A recent investigation brought out the fact that among those women who were at all interested in electrical equipment, 58 per cent had not bought because of the initial cost and another 16 per cent had been held back by the cost of current. It must be a source of tremendous satisfaction to a woman to reflect, as she bends over a tub of steaming clothes, that in so abusing herself she is saving the cost of a washer! She must feel herself to be a most magnificent help to her husband. And all she wants for it is a little "appreciation" and "sympathy." You've simply got to get her over the idea that "it pays" either in money or in "appreciation" to spend hours scrubbing clothes before you will get her to demand a washer and an ironing machine—and you will never do it by glorifying martyrdom.

Again we must agree with R. S. W. Cracker eating at the corner store until all hours is now a practically extinct sport—but not for the reason that R. S. W. infers. The cracker eater has disappeared, first because manufacturers and grocers have discovered that "it pays" to package their products, and second because there are too many other things for the erstwhile cracker eater to do. With radios, movies and automobiles the playthings of the millions, who is going to hang around an airtight stove? In other words, it isn't that people don't congregate at the store because the store is closed, but that the store is closed because people no longer congregate there. It no longer pays to keep open. But the dog wagons and the cafeterias keep open all night because "it pays." The shorter business day will be found to be prevalent only where it doesn't pay to have a longer one. And there will be shorter hours in the housekeeping game when we can prove that it pays to have them shorter. Just now the woman's reply to your offer to save her time is apt to be much like that of the farmer to whom a salesman tried to sell an incubator on the basis that it would hatch the chicks four days faster than a hen could—"What's a hen's time worth, anyway?"

Woman Likes Housework

NOW please don't try to compare the housewife to Henry Ford. If they were as smart as he is they wouldn't be housewives. He has discovered that shorter hours pay. The housewife will, we hope, eventually learn that fact, but dear Lord! what a noble job we have ahead of us proving it. Can't you, won't you see that the whole object of my pleadings is that we come down to earth and make the housewives see the good, sound, practical, economic wisdom of more work and shorter hours; that I'm trying to show that by commiserating with her and talking about drudgery you are either making her laugh or feeding her vanity. If she doesn't consider her housework drudgery your appeal is useless from the start. If she does feel herself a martyr, lacking only a crown of thorns to make the picture complete, your appeal is as futile as sympathizing with a person who has hysterics. They just go ahead and hysteric the harder.

R. S. W. assumes that because I say that the average woman likes housework and enjoys doing it that I am airing my own likes and dislikes. You think I have never made the

Woman's Principal Dislikes in Housekeeping

AT the right is a chart depicting what the average woman dislikes most in caring for her home. The small red bar at the top of the chart may be considered as having a ratio value of ten, the others increasing in multiples of ten, to approximately ninety at the bottom. Practically all of the tasks the housekeeper performs are enumerated on the chart

Home Duties a Woman Dislikes

THIS chart was compiled from information told to collectors of the Bureau of Consumer Research of Boston University who conducted a survey of Home Conditions and Use of Labor-Saving Devices, made for the New England Division of the National Electric Light Association

acquaintance of the word monotonous? Say, old man Monotony and I have been buddies for years. The reason I'm playing the typewriter instead of running the vacuum cleaner is because I've tried both and find the first preferable.

The Standard of Good Housekeeping

BUT it isn't preferable to many women. If it were, there would be more women doing what I am—getting out of doing housework by earning the money in some other way to pay someone else to do for them the tasks they inherited with their wedding certificates. Speaking personally, I consider housekeeping the world's worst proposition. It is the only job on earth which doesn't rate a salary and it is never finished. I have lived your "average woman's" life and have done her work. I've arisen at the first cold crack of dawn (more or less) and make breakfast, fed the baby, sterilized bottles, washed diapers, made formulas, cleaned and dusted and cooked, gone to market and hemmed dish towels, darned stockings and cleaned the stove. And I hated it. But, the women with whom I was in constant daily contact didn't hate it at all. They complained about it, but they never made the slightest effort to change matters. When I decided to earn by some—to me—pleasanter method, the money to pay someone to do for me those—again to me—deadly monotonous tasks, I was met with raised eyebrows and mournful shakes of the head. Something was obviously wrong with me. When I married a man of moderate means it was to be assumed that I would keep his house, cook his food, mend his clothes and rear his children. I accept all those stipulations, but I reserve the right to do them by my own methods and in accordance with the dictates of my own instincts.

I have not, however, forgotten the time spent in endeavoring to act according to the accepted standard of a good housekeeper. Nor have I forgotten what I learned from those women who lived in the community with me. And the most important lesson was that when I said I hated housekeeping and found in monotonous I meant it, while they didn't. Because you are quite justified in remaining unmoved by a delineation of personal experience; let me quote a paragraph or two from the Survey on Home Conditions and Use of Labor Saving Devices, prepared for the New England Division of the National Electric Light Association by the Bureau of Consumer Research, Boston University:

Cracker eating is no longer a great indoor sport, because other and more interesting amusements and diversions have been found. These include the automobile, radio, movies and the inclination of the now average American to travel, either at home or abroad

> On this portion of the questionnaire the collectors were instructed to record the dislike of the housekeeper for her duties. . . . The investigation brought out one of the most interesting by-products of the whole survey. It becomes clearly evident from an examination of the graphic form of our statistics that the border of dislike decreases correlatively to income. This agrees with our earlier finding that the less the woman has to spend the more careful she is likely to be about her housekeeping. Both findings point to the same truh—the minimum income householders enjoy their housekeeping and whatever they say in public, in private do not look upon their daily tasks as drudgery.

We are reproducing a list of the main hates of women, as given to the collectors of these statistics—and just look what they hate worst—care and supervision of help. We are going to quote again from this same survey:

> In this tabulation the collectors where instructed to report on the basis of their observation of definite factors such as the average appearance of the housekeeper herself, her liking for routine household operations, the order apparent in her household, and the proportion of time which she spent in outside activities as contrasted with the amount spent in housekeeping.
>
> Competence was classified in four stages:
>
> *Overcareful* means the old "poison neatness" of tradition.
>
> *Careful* was taken as enthusiasm for housekeeping combined with enough organizing capacity to keep it in its proper place even though beautifully done.
>
> *Average* we accepted as a standard not too good, but one which maintains the family in good health and spirits although details are slurred over.
>
> *Less interested* was put as a polite term for "slack."
>
> In the chart which sums up the results of these findings, attention should be especially directed to the fact that the lower the income the higher the level of perfecion in housekeeping routine. In other words, as income decreases interest in housekeeping processes rises.
>
> The most reasonable interpretation of this phenomenon seems to be that women in the low income groups are really fond of housework. This fact should be carefully considered as indicating the unwisdom of "drudgery copy" or the form of salesmanship that reasons from the

(*Continued on page* 66)

Four Classes of Women

IN collecting data about the likes and dislikes of housewives, enumerators divided them into four classes, such as those shown on the accompanying chart. The manner in which these four classes were fixed is fully explained in the accompanying article

With the Editors

The 1930 *Census of Distribution*

PLANS are now well under way in the Department of Commerce for the taking of the 1930 Census of Distribution. The new census will be an enumeration or count. It will not be a survey. Neither will it be a market analysis. It is intended, rather, to supply certain information that trade groups may use in the conduct of their business.

It should be understood that business men and manufacturers should not entertain too high hopes, or cherish too confident expectations, as to what the census will do for them individually. The census is intended to be a highly important economic study, but it can hardly be expected that it will prove a panacea for all the ills of an industry, immediately yielding large profits resulting in miraculous transformations.

Any manufacturer who expects that this Census of Distribution will give him a precise and infallible record of what happens to his motors or other products in every mercantile establishment between his factory door and that of the consumer's is inevitably doomed to disappointment. Such a thought is extravagant and a moment's consideration will show the impracticability of attempting to present any such detail.

On the other hand, the 1930 Census of Distribution will supply a classified body of statistics on the number of retailers by different lines. It will show the volume of their business and it will include some classification of commodities sold through different groups. It will be a beginning of understanding of the volume of commodities sold through different groups. Information of this kind should be invaluable to all manufacturers.

Of significant importance is the fact that the census will provide more basic information for a manufacturer formulating sales quotas, and it will give some comparison between one class of trade and another in different territories. It will contain some definite information for jobbers and retailers about the flow of commodities and the percentages handled, and it will start everybody thinking about sales costs.

Because of the outstanding importance of such a census, from an economic standpoint, every manufacturer is urged to cooperate fully, so that when he receives a tabulated questionnaire about his business or when early next spring an enumerator from the Bureau of the Census calls to ask what may seem to be a lot of impertinent questions, the manufacturer will not hesitate in answering them. This enumerator is asking these questions for the benefit of the manufacturer. And remember, this enumerator is sworn to secrecy and no figures or data will be made public that would reveal the individual business of any enterprise or establishment.

Developments in Spray Finishing

SPRAY painting or finishing methods and apparatus are now rapidly becoming understood in industry, and from day to day new uses for spray painting are being found. Some of these uses are of particular interest to electrical manufacturers.

When spray finishing apparatus was first introduced commercially, some few years ago, the equipment was somewhat crude and spraying materials had not reached their present stage of development. At best, spray painting at that time was suitable for rough work only. However, continued improvements, in both apparatus and materials, over a period of years, have made spray finishing one of the most commonly used finishing methods today. From that time when this process was suitable for little more than rough work, it has advanced until now spraying apparatus and materials are quite generally employed for applying the most ornate finishes to the highest priced commodities.

Most manufacturers know that they can finish most of their products by spraying them, but there are also uses for spraying processes other than those of finishing new products. One of these that should be of particular interest to manufacturers, in that it concerns themselves, their distributors and their dealers, has to do with refinishing methods, apparatus and materials, particularly with reference to refinishing "trade-in," "repossessed," and "shop-worn" merchandise. Equipment, materials and other facilities necessary, and some of the advantages of their use, are more fully explained elsewhere in the article beginning on page 39.

The Correct Interpretation of Standardization

PEOPLE in different industries and even in different branches of the same industry do not all mean the same thing when they speak of standardization. To one person standardization means one thing and to another it means something entirely different. According to R. M. Hudson, assistant director of the Bureau of Standards, many people think of standardization as a process by which we are forced to live in identical houses, fronting on reticulated sidewalks and ornamented by rigidly uniform shade trees; a world in which we shall dress, walk and talk alike; where the ladies must abandon their devotion to transitory style and express their individual beauty through a standard hat with a standard feather in a standard curl.

There are also those individualists to whom nothing that is, is right and must be changed regardless of cost. Either of these conceptions is wrong, of course, and there are those who have succeeded in incorporating into their products the economies of standardization and the advantages of individual design.

In an address recently Mr. Hudson pointed out some interesting points in connection with the conception everyone should have of standardization. He cited the case of a well-known manufacturer of electric cranes who has found that standardization has many advantages for his business, and he tells his customers through his advertising that standardization gives the buyer better crane value. Another interesting example of the effect of standardization is the instance in which the General Electric Company reduced a line of switches from 17 to one, thereby cutting down stocks, speeding up turnover, reducing labor costs for installation and improving delivery.

Leon I. Thomas

Managing and Engineering Editor

of ELECTRICAL MANUFACTURING

GAGE PUBLISHING COMPANY, INC., announces with pleasure the appointment of Leon I. Thomas as managing and engineering editor of ELECTRICAL MANUFACTURING.

For eleven years, or from 1914 to 1925, Mr. Thomas was managing editor of FACTORY, *the Magazine of Management*. He was associate editor, also, for two years preceding that time. Since 1925, Mr. Thomas has been consulting editor and writer on manufacturing subjects for various industrial magazines.

In 1907 he graduated from Worcester Polytechnic Institute as an electrical engineer. For three years he was chief laboratory assistant to Dr. Lee DeForest, in the pioneer days of the radio telephone, and during 1908 and 1909 was in charge of the DeForest factory. In 1910 and 1911, he was traffic chief of the American Telephone and Telegraph Company. Mr. Thomas is a member of various engineering organizations.

To his new work he brings a wealth of engineering experience, a national reputation as a writer and editor, and a wide personal acquaintance with manufacturing executives in the electrical as well as in other manufacturing fields, all of which make him a valuable acquisition to the editorial staff of ELECTRICAL MANUFACTURING.

STANLEY A. DENNIS
Editor, ELECTRICAL MANUFACTURING

"Summing up, simplified practice is merely concentration of advertising and selling effort on the sizes, types, etc., in greatest demand. In most lines of business 80 per cent of the volume of business comes from 20 per cent of the line," said Mr. Hudson.

"To the distributor, this concentration of advertising and selling efforts means increased turnover and better profits. The merchant isn't bothered with slow moving lines or dead stock. His sales force does more effective work.

"To the consumer, simplification and standardization means better value for his money, better quality, prompt delivery, quick replacement service, lower maintenance costs, simplified purchasing and better protection against shoddy or inferior goods."

Naturally all of these points affect the manufacturer. He is benefited by every effect of standardization that means better business for his distributors and the consumer. His inventories are reduced, turnover is speeded up, investments in tools and plant equipment are decreased because of the manufacture of a simplified line, and—as important as any effect that can be mentioned—distribution costs are decreased materially.

A Word About Foreign Markets

ELECTRICAL manufacturers can not live unto themselves alone. Certain great problems which affect manufacturers in other fields affect them also. Future markets, especially foreign markets, are one of these problems.

Since the close of the Great War many electrical manufacturers have been asking about the opportunities for the introduction of Americanized mass production equipment into European industries. Is Europe a market for electrical industrial and commercial equipment? Is it a market for electrical products of all kinds?

Answers to these questions, or at least a point of view from which answers may be determined, can be found in a statement recently made by Dr. Julius Klein, Assistant Secretary of Commerce. He said, in part:

"There has been much speculation as to the opportunities for the introduction of Americanized mass production equipment in European industries. The ominous possibilities of such a development in terms of more aggressive competition by Europe with the United States have caused considerable anxiety in some quarters. However, before we become unduly exercised over such a fearsome prospect, it is well to bear in mind that there are a number of formidable obstacles in the way of any such devastating 'Americanization' of the industries of the Old World. In the first place, our industrial equipment has risen largely out of the comparative need of labor-saving devices in this country. There is no situation parallel to this in Europe. The introduction of labor-saving devices in the face of millions of unemployed, as in the case of England and Germany, the two major industrial nations of the Old World, would promptly create a politico-economic situation of prime gravity. American machinery is finding a market in Europe because of its capacity to do other things than to save labor and develop mass production.

"In this same connection, it is well to remember that perhaps the outstanding feature of European industrial production is the individual skill of the artisan. This is an asset which European industrial leaders will not for a moment sacrifice by the introduction of American industrial standardization on a large scale."

A Manufacturer's Suggestions for

Designing Springs

The second of a series of articles in which a manufacturer of springs points out what information is necessary in designing these devices

By L. D. GRANGER.
Wickwire Spencer Steel Company

IN SOME form or another springs play an important part in the operation of almost every type of electrical device. As was stated in the first installment of this series, appearing in the August issue of ELECTRICAL MANUFACTURING, springs hold down brushes on commutators, they make circuit breakers operate at the proper time, they make it possible for us to measure electric loads correctly and in many other ways assist in the proper functioning of electrical apparatus. It is evident then, that a spring though insignificant is yet a very dignified object, and that the methods of first designing it, and second avoiding some of the many pitfalls in the path, are worthy of study by those electrical manufacturers who have use for springs in their various products, not alone from the standpoint of the design of the spring but also from that of knowing that the device will function properly.

It becomes necessary then in spring specifications to decide how great a variation can be allowed, and to specify it preferably in plus and minus figures from the desired mean. Table 3 shows the usual wire drawing limits. Regular drawing is, of course, commercial and the specials command extra prices. Table 4 shows what may be called commercial limits in diameters and lengths of springs for various combinations. Closer limitations than these are apt to increase the cost of the spring.

Tolerances should be specified with judgment, and close limits should not be included on the drawing without reason. The various unavoidable variations may balance one another, and the spring may be absolutely correct for working conditions, and yet overstep on dimensional specifications. For instance, a slight variation in the outside or inside diameters might be offset by a slight difference in the number of coils, and the practical working of the spring not affected in the least. A safe rule is to insist upon dimensions that are necessary and give the spring maker as much latitude as possible on the unessential details.

FIGURE 3, below, shows the data necessary for determining the kind and size of material required in a flat or cantilever spring such as would be used in the electrical industry for holding contacts in position. The formula for figuring the strength and materials for such springs appears elsewhere in this article

Table III

WIRE DRAWING LIMITS				
Ga.	*Dec.*	*Allowable Variation Either Way*		
		Regular Drawing	*Special Drawing*	*Ex. Special Drawing*
½	.500	.003	.0015	.001
15/32-14	.4687-.080	.002	.001	.0005
15-18	.072-.047	.001	.0005	Not made

TABLE III, at the left, gives the usual wire-drawing limits. These must be known and specified when designing or ordering springs, as they affect the properties of the spring materially. Regular drawing is, of course, commercial, and the special sizes command extra prices. Such factors determine the variations allowed

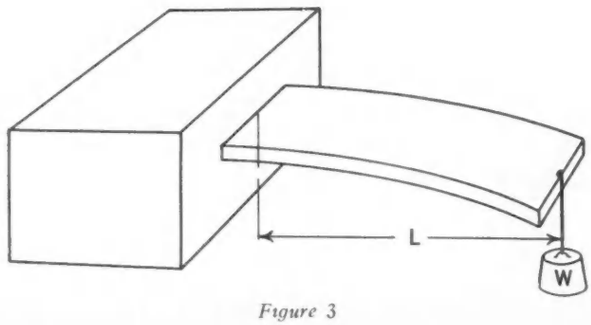


Figure 3

The various types of ends may best be illustrated. A great variety of hooks, loops and fixtures are possible according to the needs of the apparatus and the ingenuity of the designer. If an extension spring has to stand repeated extensions, it is advisable to use a separate bolt or hook with the end conical in shape, or a compression spring supplied with yokes. Plugs and other fixtures may be screwed into the helix and any number of other special applications may be devised.

While springs for electrical equipment do not present in many cases special requirements, at times they may form an essential part of the electrical or magnetic circuit. In these cases, of course, a non-magnetic material such as

phosphor bronze or brass may be required. Steel is magnetic and monel metal may be under certain conditions. At times when the springs form part of the electric circuit, considerations of the ohmic resistance and temperature coefficient may enter importantly into the calculations. Any metals, however, which may have advantages for these secondary characteristics may be formed into springs and their performance determined along the general lines set forth.

When a constant performance is desired, as in a meter spring, the spring may be artificially "aged" by a mild heat treatment, and its continual deflection to the proper point ensured to a great degree.

Compression springs may be furnished with plain, squared, or squared and ground ends, as illustrated. Plain ends usually fit into castings adapted to conform to the slope of the end, and thus make a firm seat. Squared ends are at times furnished for rougher mechanisms, but usually full squared and ground ends are made for the ordinary installation. It is necessary to allow two coils extra for plain squared ends, and from one to one and one-half for squared and ground, depending upon the amount of grinding to produce a partial or full seat.

TABLE IV, at the right, shows what may be called commercial limits in diameters and lengths of springs for various combinations. Closer limitations than these are apt to increase the cost of the spring. Tolerances should be specified with judgment, and close limits should not be included on the drawing without reason. The different unavoidable variations may balance one another and the spring may be correct and yet overstep specifications

Table IV

Spring O. D.	Var. O. D.	Under 1"	Allowable Variation in Free Length 1–2"	3–4"	5–6"	7–8"	9–10"	11–12"	13–14"	15–16"
1/8	.005	1/32	3/64	1/16	1/16	3/64	3/32	1/16	3/64	5/32
5/16	.005	1/32	3/64	1/16	1/16	3/64	3/32	1/16	3/64	5/32
1/4	.008	1/32	3/64	1/16	1/16	3/64	3/32	1/16	3/64	5/32
3/16	.008	1/32	3/64	1/16	1/16	3/64	3/32	1/16	3/64	5/32
7/16	.010	1/32	3/64	1/16	1/16	3/64	3/32	1/16	3/64	5/32
1/2	.010	1/32	3/64	1/16	1/16	3/64	3/32	1/16	3/64	5/32
9/16	1/64	1/32	3/64	1/16	1/16	3/64	3/32	1/16	3/64	5/32
1 1/16	1/32	1/32	3/64	1/16	1/16	3/64	3/32	1/16	3/64	5/32
1 1/2	1/32	1/32	3/64	1/16	1/16	3/32	3/32	1/16	3/64	5/32
1 3/4	1/16		3/64	1/16	1/16	3/32	1/16	1/16	3/64	5/32
2"	1/32			1/16	3/64	3/32	1/16	1/16	3/64	5/32
2 5/16	1/16								1/32	11/64
3 1/16	3/64								1/32	11/64

IN Figure 4, below, the minimum power required to operate the mechanism is indicated by the dotted line. All the strength of the spring above this is unnecessary and must be counteracted by regulation. The more nearly the performance curve of the spring approaches the horizontal, the longer will it run and the smoother the action. Variations in spring action may be obtained by increasing the length of the spring, and the diameter of the wire

Compression Springs

Material—Kind and size of wire. (If we experience difficulty in meeting specification may we change size?)

Dimensions—Max. allowable outside diameter of spring. Min. allowable inside diameter of spring. (Or size of rod and hole spring works in).

Free length, maximum and minimum. (In squared ends allow for inactive wire).

Style of Ends—Plain, plain ground, square only, square and ground, and square and ground to stand square with axis. (Means precision work.)

Wound right or left hand.

Maximum allowable solid height.

Number of coils or pitch.

Finish—Kind? Any special method of packing.

Specifications—Load specifications—What is the desired strength of the spring?

What is the weakest and what the strongest spring acceptable in terms of pounds load for any given deflection?

Do springs compress solid?

How fast do they work? (compressions per minute).

How about settage?

What is the assembled length and the working range of the spring?

Is the temperature surrounding the spring abnormal?

What is the degree of precision required? Will detail inspection be required?

Extension Springs

Extension springs may be specified in accordance with the following data:

Material—Kind and size of wire (allowable to change size of wire to get load if necessary?)

Dimensions—Number of coils, length of coil body or both. Length overall. (Usually specified inside of hooks which is the measure of the span over which the springs fit.)

Diameter—Maximum and minimum. In connection with this item, does anything screw into the coils?

Style of ends—Regular hooks or loops in line or at right angles, hooks or loops on side, across center, or bent across center, coned ends with loose hooks, plain ends to receive screw plugs. There are countless special methods of fastening extension springs.

Allowable variation in free position of ends. This is very important from the standpoint of cost.

Finish—Kind and quality.

Specifications—Initial tension desired—i.e., load spring will sustain before opening between coils becomes apparent or before spring elongates appreciably.

Scale of spring or load to be carried at given extensions. Specify with variations.

Range of deflection and number per minute.

Maximum stretch spring must stand before setting.

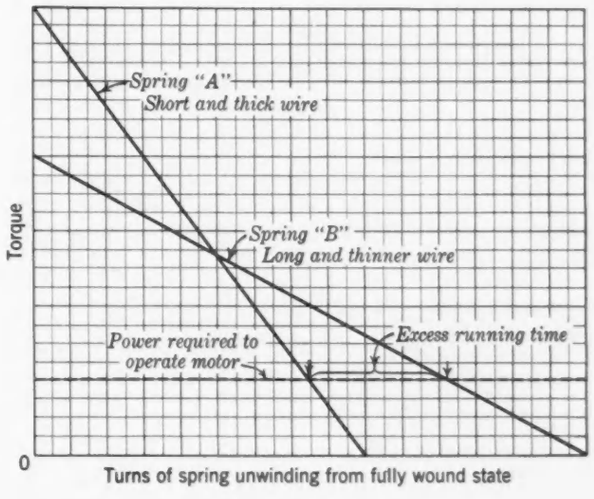


Figure 4

Practically every condition however severe may be met by the proper design and material. A recent development has enabled a spring to be furnished that will function continuously at a temperature of 900 deg. F. without fatigue or set, a feature of utmost importance in certain types of equipment.

The range of use and nature of torsion springs is so wide that it is difficult to generalize in this case. Spring makers are not at all in accord as to the proper formula to use for their design, but we have found that a very close approximation may be secured by the following formula:

$$P = \frac{9{,}250{,}000\ T\ d^4}{LR}$$

Where P = pounds pull
T = no. of revolutions (360° each) made to produce load
d = diameter of wire
L = developed length of wire in spring (2 TT DN)
R = radius in inches at which P acts

In order to determine the stress to be used, this formula applies:

(6) $$S = \frac{2.54\ PR}{d^3}$$

S = stress

This will give a maximum stress to be used of about 100,000 lb. per sq. in.

The actual load on a flat spring is often of secondary importance, its main duty being a "keeper" to hold some corrode in use, and which may be soldered or spot welded.

In flat springs the formula becomes of a different form than for helicals. If we suppose a flat bar held rigidly at one end and subjected to a load W at a distance L from the fixed end, the deflection from the horizontal is:

(7) $$f = \frac{4\ WL^3}{Ebh^3}$$

in which f = deflection
W = load
L = distance of application of load
E = modulus in tension
b = width of wire
h = thickness

It will be noted here that the modulus of elasticity in tension is required, on account of the nature of the stress

THE torsion spring shown at the right is very similar to that in Figure 6, except that the end or loop is of different design. In such springs it is essential that the manufacturer have all dimensions for the making of the loop, and at the same time the kind and size of material

Figure 7

AT the right is one type of extension spring to which are attached a loop or hook at one end and a stud or bolt at the other. In such springs it is necessary to supply the manufacturer with all essential dimensions

Figure 5

IN ordering such springs as that shown in Figure 5 it is necessary to specify the size of the loop and the stud at the opposite end, as well as the diameter of the wire in the spring, the number of coils and direction of winding

operative part in place or to make a contact as in a jack. The telephone and radio industries use millions of them, made of steel, german silver alloys, monel metal, brass or phosphor bronze. These operate usually as cantilever springs; that is, held fast at one end, the other being deflected by some means to make contact through a special contact spot of some corrosion resisting metal. The manufacturing conditions require the following properties:

1. The metal must be able to be adjusted while in place; that is, slight changes in position should be possible by means of pliers.
2. The working stress must be such that the spring will not fatigue and break in service.
3. The properties must be constant; that is, the metal must be carefully chosen to avoid weakening from ageing or season cracking. This eliminates the use of some nickel silver and brass alloys.
4. If used for contactors with no special points interposed, alloys containing zinc which will volatilize under the arc should not be used.
5. Usually alloys are required which will not rust or

Figure 6

AT the left, in Figure 6, is one type of torsion spring that is commonly used. In designing such springs as these, extreme care should be exercised to determine that the spring does not bind on the shaft when it is wound up, and that there is ample room for expansion as it unwinds

in the spring.

Clock and motor springs may be considered to be long, flat springs trying to straighten themselves out. Their function is to run a clock or a motor a certain length of time, and to do it with as constant power as possible in order to make regulation less difficult. Generally speaking, for commercial applications, not over fifteen turns of effective operation may be secured from a spring, while for chronometer work many less than this are utilized.

In Figure 4 the minimum power required to operate the mechanism is shown by the dotted line. All the strength of the spring above this is unnecessary, and must be counteracted by regulation. The more nearly the performance curve of the spring approaches the horizontal, the longer will it run, and the smoother the action. The flatter slopes are secured by increasing the length of the spring and decreasing the thickness of the steel. The total amount of work of the two springs is the same, their weight is the same, but the effect is far different by reason of the distribution of the energy.

It is impossible to write everything about springs. Their design is fascinating, as their problems are ever new and changing. The spring designer must have imagination and charity and the manufacturer must be an artist and a master of subterfuge and ingenuity. Properly in accord and with the help of Archimedes, springs could be designed and made to move the world. Proper design and manufacture now have made almost as great miracles possible, and the spring manufacturer stands ready with advice and materials to assist in making practical the wildest dreams of inventors as well as serving faithfully the everyday application of the practical machine designer.

Characteristics That Determine the *Selection* of MOTORS

No. 16 of a Series Discussing Motors of Different Types

The selection of motors and control apparatus for motor driven machines is as important a problem as any other in the design of machinery

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AND

C. P. ROBINSON
Synchronous Engineer
Ideal Electric & Mfg. Co.

THIS installment of the series on the characteristics of motors that determine their selection for various applications to motor driven machines continues the discussion of the control apparatus as well as the motors used on some typical applications. In the previous installment motor and control applications to cranes was taken up and this subject is concluded here.

Figure 32 shows the interior of the cab, with the main distribution switch cabinet mounted on the wall and the three controlling switches mounted at a convenient height for the operator's use.

Figure 33 shows a view of the assembled control for crane operation. The control panel is shown with main switch, circuit breaker, and fuses. The three drum type controllers are shown in the foreground, while directly behind can be seen the resistor units for dynamic braking.

Another similar application is the electric car dumper for coal or ore unloading. The equipment in this case consists of one motor to haul the load to the top of the incline and some small auxiliary motors. The compound wound motor is preferable in this case. The motor operates during part of the cycle, while the car is being dumped, at practically no load, and unless the friction load is fairly heavy, a series wound motor would run away. The compound wound motor is used in preference to the shunt wound motor because of the heavy torques required. The return of empty cars to track level is usually accomplished through dynamic or regenerative braking. The control used in this case is similar to that used for crane motors.

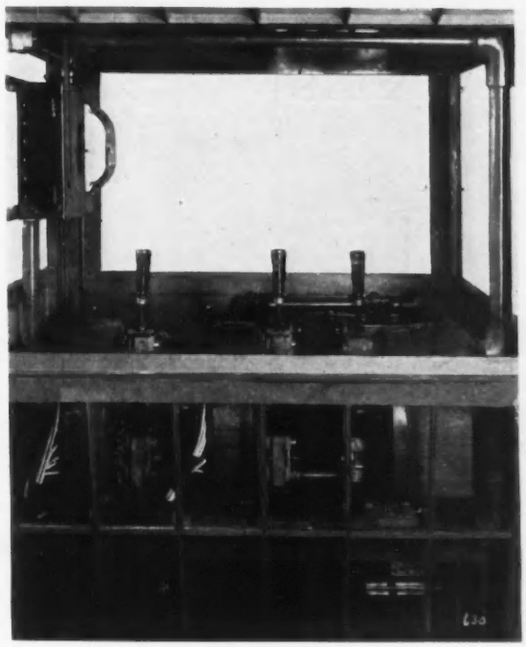


Figure 32
The interior of a crane cab, other views of which were shown in the preceding installment (Figures 30 and 31)

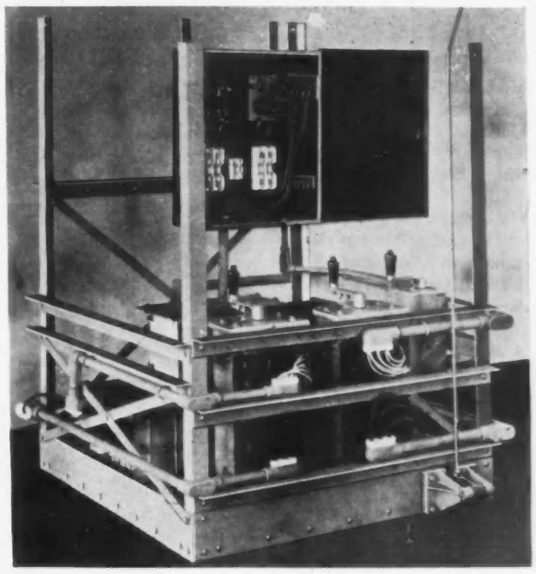


Figure 33
The assembled control for crane operation. The control panel is shown with the main switch, circuit breaker and fuses

D. C. units provide flexible control for electric drives in coal unloading and distributing towers for central power stations.

Installations have been made using generator voltage control. By proper manipulation of the generator field the hoist motor will lower and retard the bucket nearly to a

standstill by means of regenerative braking. This again leaves to the friction brake the comparatively light duty of holding the motor at rest.

Some of the advantages realized by using generator voltage control are as follows:

1—The armature circuit between the hoist motor and driving generator remains closed at all times except in a case of emergency, so that only field currents of comparatively low magnitude are handled by the control. Thus the cost of control becomes a minimum and its operation is made extremely simple.

Figure 34

FIGURE 34 *shows a compound wound, direct current motor driving a cable hoist such as those used in hoisting building materials*

The characteristics of the shunt motor with varying resistance in the armature circuit closely parallel those of the slip-ring motor with varying secondary resistance, as shown in Figure 35

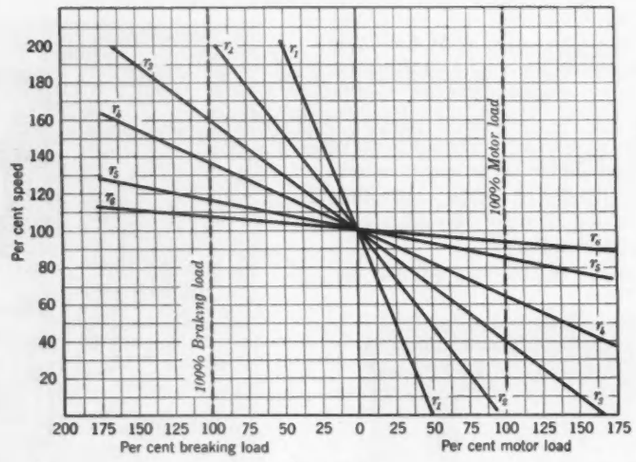


Figure 35

THE shunt wound motor can be used to give low speeds when driven as a generator by an overhauling load, by use of a dynamic braking circuit consisting of a resistance connected across the armature and another in series with the shunt field. Figure 36 *shows motor torque and braking torque obtained by this connection and also the speeds corresponding to* 100 *per cent overhauling load*

2—Great accuracy of speed control and stopping is provided due to the low or creeping speeds that are possible.

3—The rate of acceleration is largely determined by the rate of rise of generator voltage, and since it is impossible to secure abrupt increments of generator voltage, the acceleration and retardation becomes exceedingly smooth and free from sudden torque changes of the hoist motor.

Frequently the hoist motor finds service in construction work. Figure 34 shows a compound wound direct current motor driving a cable hoist, typical of that used in hoisting materials for building purposes. The compound wound motor should always be used for this application in preference to the series motor. The loads are apt to be light at times and there is also the possibility that the cable might break suddenly relieving the motor of its load.

Conveyor Applications—Nearly every modern industrial plant has one or more conveyor applications when the class of work permits of conveyor assembly of the product, or where a conveyor system saves time and extra handling of products. The automobile industry is particularly noted for its conveyor assembly belts. Nearly every type of conveyor application differs to some extent from every other type. But there are certain fundamental characteristics that are helpful in considering such an application.

For a variable speed conveyor drive, where direct current is available, the adjustable speed shunt wound D. C. motor is preferable. The armature shifting shunt wound motor is, of course, equally satisfactory. As a conveyor may be running light at times, the same danger exists for a series motor drive as mentioned in connection with other applications; namely, that the motor might develop dangerously high speeds, particularly with an overhauling load.

A shunt wound motor must be used in the case of a retarding conveyor. A series motor might be used by making provision for a retarding torque through a dynamic braking circuit, but this would needlessly complicate the control circuit, and the results would be somewhat uncertain.

The characteristics of the shunt motor with varying amounts of resistance inserted in the armature circuit closely parallel the characteristics of a slip ring A. C. motor with resistance in the rotor circuit, as shown in Figure 35, which shows the shunt characteristics of torque and speed as a motor and dynamic braking torque as a generator. The largest value of resistance in the armature circuit gives the lowest speed and lowest motor torque, and gives lowest dynamic braking torque at the highest overhauling speed.

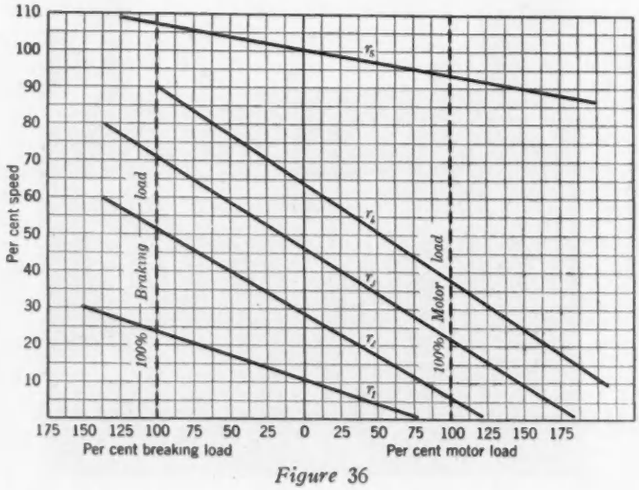


Figure 36

The shunt wound motor can be used to give low speeds when driven as a generator by an overhauling load, by use of a dynamic braking circuit consisting of a resistance con-

nected across the armature and another in series with the shunt field. Under these conditions the motor will draw current from the line. Figure 36 shows motor torque and braking torque obtained by this connection, and also the speeds corresponding to a 100 per cent overhauling.

Provision must be made, however, to prevent such a shunt motor from overspeeding in case the power fails on its supply line, particularly when a shunt solenoid brake is used. Under this condition the motor acts as a shunt generator and continues to supply power to its own shunt field and to the coils of the shunt solenoid brake, keeping the brake released. Since the motor is provided with a circuit for the power which it is trying to generate, it will overspeed to the point of destruction, unless some means is provided to break this circuit. A centrifugal switch or an over voltage relay will suffice. The contacts of this switch or relay must be in series with the brake coil, so that this circuit is opened, permitting the brake to set and stop the motor.

This particular application would apply only to variable speed conveyors subject to retardation. A conveyor system is sometimes used to convey a product up to the ceiling of a room, out of the way, where it is then carried along until it descends again for another operation on the product. This saves handling and uses space which would not be utilized otherwise. Such a conveyor or similar applications may be subject to motor torque at some load stages and to motor retardation torque for other load stages. These effects are equalized to maintain an even pull on the conveyor system by the method described.

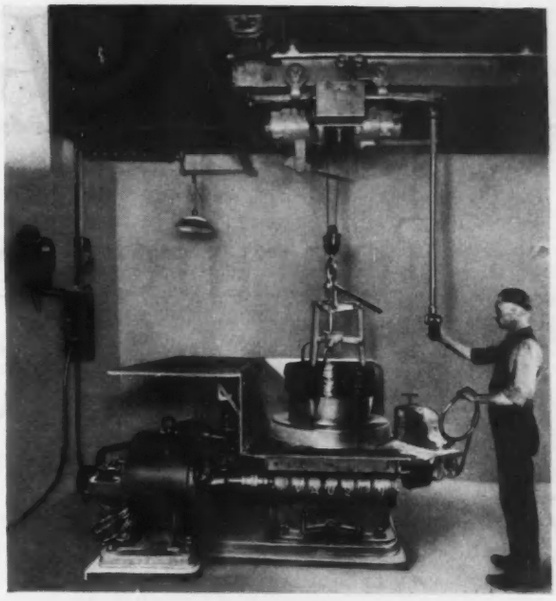


Figure 39

FIGURE 37 shows an application of two armature shifting, adjustable speed, shunt wound motors driving large conveyor systems in a commercial bakery. A wide range of speed is required for the different uses to which huge baking ovens of this type are put. These motors are rated at 7½ hp. with a speed range of 200 to 1600 r.p.m. by automatic control. The automatic armature shifting device is driven by a sprocket and chain arrangement

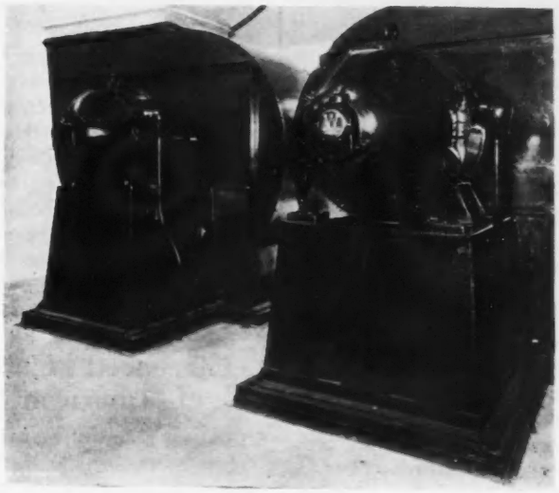


FIGURE 38 shows two shunt wound, adjustable speed motors driving ventilating blowers such as are used for cooling systems in large modern theatres and other public buildings

An individual wire drawing block driven by an adjustable speed shunt wound motor is shown in Figure 39. The main control units for this application are mounted on the adjacent wall. This is another case where individual drive has meant greater production with greater safety and better control over quality

Figure 38

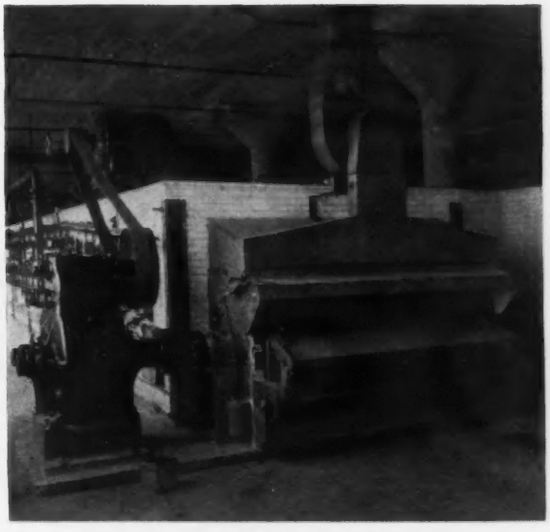


Figure 37

There are many other conveyor systems where there is little tendency toward an overhauling load at any time, constant horsepower and variable speeds only being required.

Figure 37 shows an application of two armature shifting, adjustable speed, shunt wound motors driving large conveyor systems in a commercialized bakery.

The control for D. C. motors used in this connection is quite simple. One type of control which is particularly suitable for conveyor control or any case of gear drive, consists of an automatic starter with series contactors, operating on a time element principle, which allows for taking up the backlash of the gears before the full starting torque is applied. In the case of belt or chain drive, a standard resistance starter can be used which permits only a low initial torque and then applies full torque gradually.

Figure 38 shows two shunt wound adjustable speed motors driving ventilating blowers such as are used for cooling systems in large modern theaters and other public buildings.

Figure 39 shows an individual wire drawing block driven by an adjustable speed shunt wound motor. The main control units are mounted on the adjacent wall. The rheostat control handle can be seen directly back of the motor.

(To be continued)

NEMA Fall Meeting

Features Seven Trade Practice Conferences

THE first trade practice conferences to be held in the electrical industry will be conducted during the annual meeting of the National Electrical Manufacturers Association at the Wardman Park Hotel, Washington, D. C., Oct. 7-12. Conferences are scheduled for seven industry groups represented by the Mica, Panelboard, Outlet Box and Conduit Fittings, Flexible Cord, Vulcanized Fibre and Carbon Sections of Nema.

As this issue of ELECTRICAL MANUFACTURING goes to press, final plans for the annual meeting of Nema are being arranged. It is expected that more than three hundred Nema members will attend the meeting at which a number of prominent speakers have been invited to address the Policies Division sessions—among them Robert E. Lamont, Secretary of Commerce. There will be two meetings of the Policies Division—a general session on Oct. 8 and an executive session on Oct. 9. The election of governors will be held on the latter date.

It is hoped that President Hoover will be able to receive the members of the association sometime during the annual meeting. A communication has been received by Alfred E. Waller, managing director of Nema, from the Secretary to the President, stating that definite word regarding the official reception will be given later.

The annual meeting will be opened on Saturday, Oct. 5, with a meeting of the Standards Committee. The Casualty and Fire Prevention Committee and several section meetings are being scheduled for Monday, Oct. 7.

Tuesday will be taken up with section meetings and the open general session of the Policies Division in the evening. At the present writing a tentative program has been prepared for the Policies Division meeting as follows:

President's Address—H. B. Crouse; The Future Nema—Alfred E. Waller, managing director of Nema; Self Regulation in Industry—Robert E. Lamont, Secretary of Commerce; Market Development—W. E. Sprackling, Chairman, Electrical Industry Sales Conference; The S. E. D.—What It Means to Manufacturers (Speaker to be announced); Tariff Situation Today—Thomas Allen, chairman, Nema Tariff Committee.

On Wednesday there will be a meeting of the retiring board of governors, section meetings and a meeting of the Section Council. At the latter meeting, Marshall T. Jones, Chief of the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, will explain the service the Department of Commerce is prepared to render electrical manufacturers in domestic and foreign fields.

The executive session of the Policies Division and the election of Governors will be held Wednesday evening. The following program is a tentative outline for that meeting:

Financial Condition of Nema—R. H. Goodwillie, treasurer, Nema; Budget Recommendations—J. F. Kerlin; Election of Governors—Paul G. Duryea, Chairman, Nema Nominating Committee; Credit Plans Affecting Jobbers and Manufacturers—George E. Cullinan; Advisory Legal Counsel—C. L. Collens, Vice-President in charge of Policies Division; Conditions Affecting Free Distribution of Electrical Products—S. L. Nicholson; Quality Improvement Program for Customers' Electrical Equipment—Speaker to be announced.

Trade practice conferences will be the feature of the meeting on Thursday. The six conferences of Nema groups —as stated in the foregoing—have been arranged with the Commission. A luncheon meeting of the new board of governors will also be held on Thursday. The new officers will be elected at that time. Section meetings will be held both morning and evening on Thursday. Section meetings are also scheduled for both Friday and Saturday.

While there will be no organized program of recreation at this meeting, numerous bus rides and sight-seeing trips can be arranged at the convenience of the members. Busses will also be available for conveyance to nearby golf links.

Clarence L. Collens Appointed to Board of American Standards Association

Clarence L. Collens, vice-president in charge of the Policies Division of the National Electrical Manufacturers Association, has been appointed to the Board of Directors of the American Standards Association. Mr. Collens was designated for that position by Nema which is a member body of the A. S. A.

In announcing the appointment of the first Board of Directors of the American Standards Association, the Advisory Committee states that this is the final step in the reorganization of the former American Engineering Standards Association.

Mr. Collens is president of the Reliance Electric and Engineering Company of Cleveland, Ohio.

W. D. Little Head of Furnace Section

At a recent meeting of the Electric Furnace Section of Nema, W. D. Little was reelected chairman and R. F. Benzinger, secretary. Both are executive members of Nema, the former being associated with the Hoskins Manufacturing Company, of Detroit, and the latter with the Electric Furnace Company, Salem, Ohio.

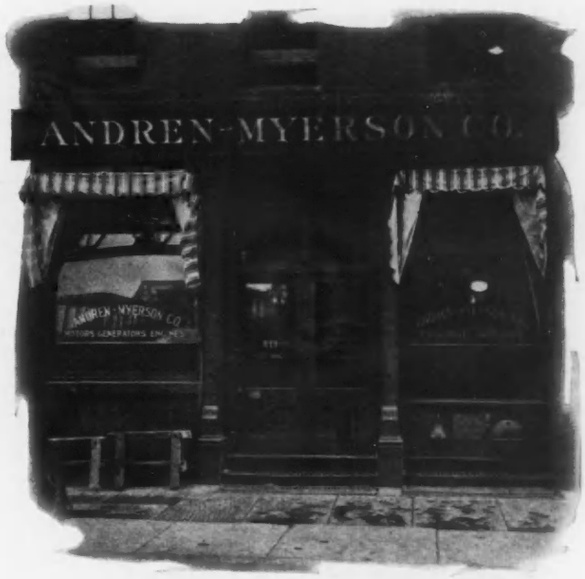
Radio Statistics Released

Radio Division reports that radio sales totaling $91,000,000 were indicated for the months of April, May and June, 1929. Estimates of total sales for the radio year, from June 30, 1928 to June 30, 1929, place the figure at approximately $510,000,000. More than 3,108,000 receivers of all kinds were sold, of which only thirteen per cent were battery sets.

Rebuilding Motors for Resale

One of the largest dealers in second-hand electrical equipment in the New England territory is the organization of Andren-Myerson Company, at 411 Atlantic Avenue, Boston, Mass.

By William Wallace



CONNECTED with practically every industry of any importance throughout the entire country there are in existence those organizations that are engaged primarily in the buying and selling of what is known as second-hand equipment. By this is meant the buying and selling of such mechanical devices as have become antiquated; those that are practically worn out from long usage; and those that have been replaced by other equipment, possibly because of changes or improvements in facilities.

In the electrical industry there are to be found many dealers in second-hand motors, control apparatus and other electrical equipment. They make a practice of buying such equipment in a used condition; repairing it and then offering it for resale, at prices usually lower than that charged for similar new apparatus. One or more of these dealers is to be found in every large industrial center and their place in the business world has come to be recognized as necessary. Many of them, as part of their business, rent electrical apparatus, and in cases of breakdowns or emergencies this practice has often prevented many serious delays in manufacturing plants and other institutions.

In industrial New England, and particularly in that section with Boston as its center, there are many manufacturing plants, and, as is generally well known, most of their products are leather goods, textiles and mechanical devices. Serving many of these industries is the Andren-Myerson Company, at 411 Atlantic Avenue, in Boston. This company specializes in nothing else but second-hand equipment, although it does handle some new replacement or repair parts, but it does no wiring of any kind and it is not essentially an electrical repair shop, only insofar as it repairs secondhand apparatus for resale.

Some years ago, Andren-Myerson was two separate organizations, with the late Karl Andren, president of the Karl Andren Company, and Joseph Myerson head of his

THE offices, repair shops and part of the storage space of the Andren-Myerson Company, dealers in second-hand electrical equipment at 411 Atlantic Avenue, Boston, Mass., occupy two floors of the industrial building above, in the center of the commercial district of the city, which is near the industrial section

THE electrical apparatus repair department of the shop of the Andren-Myerson Company is divided into sections, each arranged and equipped to do some specific work in the reconditioning of motors and other devices. That section shown at the left is used for repairs to coils and windings, and it has all the facilities for the work

organization. Both companies were engaged in the same business, in competition with each other in the same territory. After the death of Karl Andren, in 1908, H. P. Caddy, who had been sales manager for the Andren Company, assumed charge of the business of the Karl Andren Company and continued to conduct it in competition with the Myerson Company until 1929. In March of this year, Mr. Caddy and Mr. Myerson consolidated the two organizations under the present name, with H. P. Caddy, president, and Joseph Myerson treasurer.

As Mr. Myerson explains the consolidation: "There was enough business in the territory for both of us, but by joining the two companies we are able to handle the same amount of work as we did before, but with a smaller organization and considerably less overhead and operating expense."

Today the Andren-Myerson Company is one of the largest organizations in New England. In its present quarters on Atlantic Avenue it occupies two floors of a large industrial building, and in another near-by building is a spacious wareroom for the storage of reconditioned electrical apparatus, which is always carried in stock ready for resale, in addition to that usually to be found on the shipping floor of the factory building.

As has been stated, Andren-Myerson will not do any kind of wiring, not even the hooking up or disconnecting of a motor. For this reason the company has no workmen in the field, although it employs an average of about fifteen electricians, machinists and repairmen in its shop. These, because of the volume of the work, are assigned to specific tasks. In other words, there is one group that handles all dismantling and assembling. In the same section of the shop with these men is the test equipment and these workmen assist the foreman in testing and inspecting all work coming into the shop for repairs and that reconditioned and ready for resale. All such operations as would come under the general head of machine shop work are handled by another group of men in a section of the shop fitted with an adequate complement of tools and other necessary facilities. The work in this department includes the fitting of bearings, machining commutators, fitting pulleys and other machine operations incident to the reconditioning of electrical apparatus.

Method of Buying and Selling

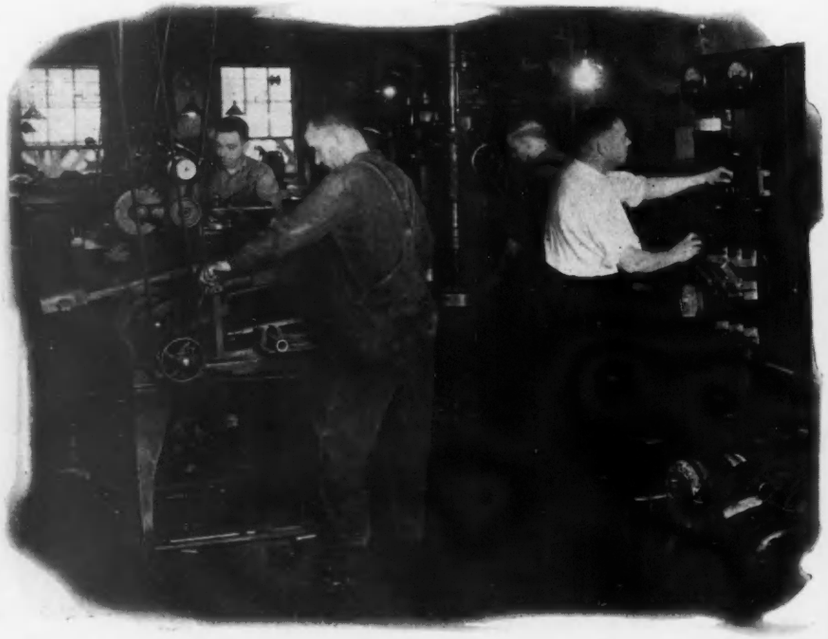
REPAIRS to coils, such as winding, spreading and taping as well as assembling in stators and rotors is all carried on in still another section of the shop and by a group of workmen assigned regularly to the performance of this work.

In the buying and selling of second-hand equipment for Andren-Myerson Company Mr. Caddy acts as sales manager, devoting practically all of his time to work in the field, while Mr. Myerson handles such sales and buying as are done at the office and shop. In this manner, Mr. Caddy is in constant touch with his customers. He knows generally what they have in the way of electrical equipment and at the same time can estimate their future needs. With Mr. Myerson at the office he is at all times familiar with stock on hand and undergoing repairs, so that he is always in position to arrange for the prompt delivery of such apparatus as might be required.

It must be understood that in the buying and selling of second-hand equipment one must have a most comprehensive knowledge of the cost of similar new equipment and at

IN addition to a large warehouse, near the principal offices and repair shop of the Andren-Myerson Company, considerable electrical apparatus is always in stock on the first floor of the shop building on Atlantic Avenue. This, for the most part is ready for use, although some of it is awaiting repairs. Along the walls of this room, as may be seen in the illustration above, there are racks and bins in which are stored repair and replacement parts

SINCE a small part of the business of the Andren-Myerson Company is that of building special panelboards on order, part of the motor repair shop is set aside for this work. In the view at the right is one of these special panelboards as it is undergoing tests before delivery. At the left of the illustration and in the background may be seen the machine department of the repair shop. In it are many kinds of machine tools and much other equipment



the same time a very close conception of just what the cost of rebuilding or reconditioning the apparatus will be. A knowledge of these things makes for the difference between profit and loss, and such knowledge can only be had from long and intimate contact in the business, both of which Mr. Caddy and Mr. Myerson have had.

All apparatus entering the Andren-Myerson Company shop for repairs, as well as that sold, is handled directly through the front door of the shop, for the reason that the building is so situated that no other entrance is available. This condition makes it necessary that all transportation be handled by trucks. An overhead monorail conveyor, fitted with a heavy chain hoist, is used for loading and unloading the various pieces of equipment and this same hoist, running the full length of the first floor, is used for transporting motors, generators and the like to the elevator connecting with the upper floors of the building.

All apparatus awaiting repairs and that already reconditioned and awaiting resale or delivery is stored on the first floor, directly in the rear of the offices, which occupy the front of the building. In the same section with this apparatus is a vast assortment of replacement and repair parts. These are stored in bins, as may be seen from reference to one of the accompanying illustrations. Included in this stock are bearings of many types and sizes, carbon brushes, shunts and many other parts ordinarily required in electrical apparatus.

Shop Working Methods

WHEN a piece of equipment enters the shop, such as a motor, a complete record is made, setting out all of its characteristics. This is retained in the office and a similar card is attached to the work. These cards form a stock record and serve to identify the motor again after it has been placed in condition for resale.

All repair work, involving complete dismantling of the apparatus is done on the second floor of the shop. As the work leaves the elevator it passes directly to the inspection bench, which is in close proximity to the test board. At this point a most exacting inspection is made and each defect found is noted on a work slip or card. Ordinarily there is no urgent necessity for reconditioning any particular piece of equipment so that after undergoing tests the apparatus is placed on the floor.

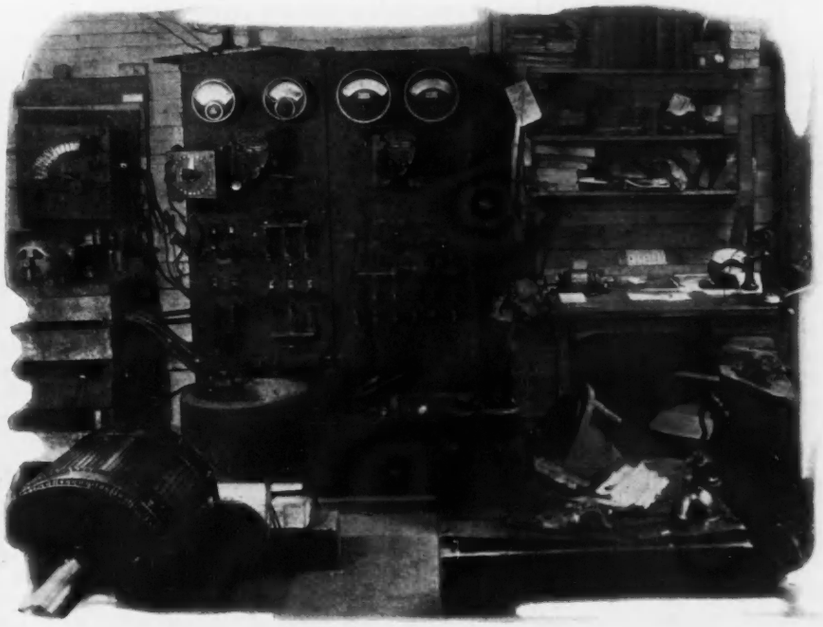
Near the test bench is the dismantling and assembly section of the shop. It is here that all apparatus is completely taken apart, to insure that all defects receive proper attention. Shafts, armature bearings, and the like, pass to the machine department. Rotors, stators and any coils in need of repair or replacement pass to that section of the shop where this work is done. After the various parts of a motor, generator or some control apparatus have been repaired they return to the assembly department, where they are put together, tested, painted and turned over to storage.

In the test department, and aside from the benches, small

tools and other similar facilities, there is a full complement of test apparatus arranged to supply any power ordinarily required for making a complete test of almost any kind of electrical apparatus.

The machine department is fitted with lathes, both large and small, drill presses, an arbor press, shapers, power saws and several small bench machines for the lighter work.

Throughout the Boston territory Andren-Myerson Company is known for the high quality of its work, and as may be seen from reference to the accompanying illustration, this may be due, aside from efficient management, to the full complement of repair facilities and the workmanlike manner in which they are used.



THE first operation in reconditioning a motor in the Andren-Myerson Company shop is that of a careful test and inspection, and to make this complete requires that the motor be dismantled after its electrical circuits have been tested, so that all of the various mechanical parts may be examined. This is done on the benches shown in the view at the top of this page.

IN the view at the left may be seen part of the test equipment in the motor repair shop of the Andren-Myerson Company in Boston. It includes two panelboards and the necessary auxiliary control apparatus, so arranged that practically any type or kind of electrical equipment can be examined in this shop. All of this equipment is within easy reach of the work benches shown in the view above, where the motors and other devices are dismantled for inspection

Checking and Testing Motor Applications

No. 3 of a Series on Electrical Testing Instruments and Methods

A continuation of the discussion of those factors that enter into the tests and selection of motors and control apparatus for machine tool drives

By D. H. Braymer
Consulting Engineering Editor
Electrical Manufacturing

IN the section of this article that appeared in the August issue of Electrical Manufacturing, details were presented on the torque and speed characteristics of induction motors for general purpose applications. In this instalment an analysis of starting requirements will be given.

The current inrush when starting a squirrel cage induction motor is usually of short duration with the current falling quickly from the values given in the table on page 47 of the August issue, to the running or full load value as the motor comes up to speed. This initial current inrush can be controlled by reducing the line voltage impressed on the stator. It is usual therefore, on motors larger than 5 hp. to use a starting device that will provide a voltage at the start just sufficient to start the load. If it is desired to secure full load torque from a motor at starting that will provide say, 225 per cent of full load torque at standstill with full line voltage, then the required starting voltage may be calculated as follows:

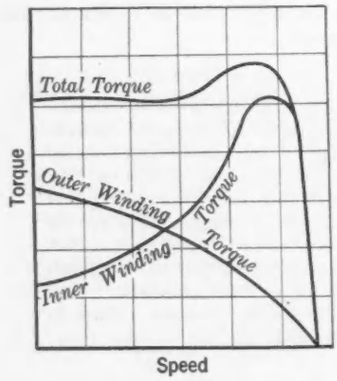


Figure 1

AT the left are shown some typical speed-torque curves for a double squirrel cage motor. During starting the high resistance winding predominates and the starting current is reduced. Maximum torque of this motor is not much greater than its starting torque

Starting voltage = Line volts $\times \sqrt{(1 + 2.25)}$, = 0.66 $\times$ Line volts, or approximately 66 per cent of line voltage.

Small induction motors up to 5 hp. can be usually started on full line voltage when it is not objectionable to bring the driven machine suddenly up to full speed.

The full load current for an induction motor, from which the starting current can be calculated, may be derived from the following horsepower formula:

$$\text{Hp.} = (2 \times 3.1416 \times \text{T} \times \text{r.p.m.}) \div 33{,}000$$
$$= (\sqrt{3} \times \text{EI} \times \cos\theta \times \text{Eff.}) \div 746$$

Or $\text{I} = (\text{hp.} \times 746) + \sqrt{3} \times \text{E} \times \cos\theta \times \text{Eff.})$

In this formhula, T equals torque in foot-lbs; E is line voltage; I is amperes per terminal of motor; cos θ is power factor. This formula holds also for single and two phase motors if $\sqrt{3}$ is replaced by 1 and by 2.

Motor Starting Methods—The commonly used methods for starting induction motors are the following:

1. Throwing the motor directly across the line and applying full line voltage by the use of a hand operated fused switch or by use of a magnetic starter providing overload protection by relays and also undervoltage protection.
2. By use of a hand operated or an automatically operated auto-transformer starter or compensator.
3. By use of an impedance starter.
4. By use of a primary resistance starter.

As already mentioned across-the-line starting is satisfac-

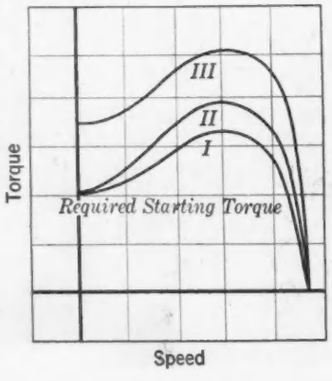


Figure 2

AT the left are comparative speed-torque curves in which I is for auto-transformer starting; II is for primary resistance starting with higher torque since the voltage increases as the motor accelerates, and III is for across the line starting giving the highest starting torque

tory for small motors up to 5 hp. rating. The starter itself is simple and cheap but it can only be used where rapid acceleration of the motor is permissible. It also has an application with the so-called double winding or double deck type of induction motor constructed with two sets of rotor bars so as to produce the effect of a high resistance rotor during starting with lower starting current than the standard induction motor with the single squirrel cage rotor. This type of motor has many applications where a pull out torque less than the standard squirrel cage motor can be used.

The auto-transformer starter or compensator has been long and widely used as a method of reducing the line voltage at starting. This device consists of a special transformer provided with taps for obtaining reduced line voltage and a double throw operating switch by which the motor is first thrown on the transformer connection during starting and then thrown across the line when full speed has been reached. Due to the high current inrush required to magnetize the auto-transformer core when first connected to the line, the oscillograph shows a violent current surge which may cause annoying line disturbances. A compensator requiring a normal exciting current of three amperes may cause a current inrush as high as 80 amperes for several cycles before the current becomes normal. When the motor is disconnected from the auto-transformer and connected to the line by the change over switch, a definite break occurs in the circuit and a second current inrush takes place. The reason for this is that during the switchover the stator current is zero but the stator flux does not disappear instantly. While it is being reduced and the rotor is slowing down, current is induced in the rotor and a revolving field is produced at rotor speed which generates a counter e.m.f. in the stator. This counter e.m.f. is less than line voltage and is lower in frequency because the rotor is slowing down. When the stator is reconnected to the line and line voltage is impressed, the counter e.m.f. is usually out of phase with the line voltage and the current inrush may approximate a short circuit, thus producing this second inrush of current. Under certain conditions the operation of the compensator on large motors may be objectionable to the power company furnishing service and cause lamp flicker when lamps are connected to the same feeder circuit. These sudden inrushes of current are also hard on the windings of the motor and on the driven machine.

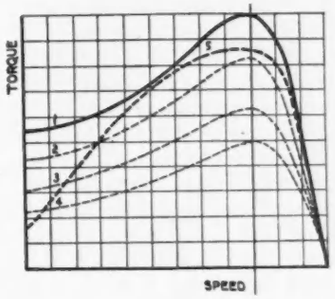


Figure 3

SPEED - TORQUE curves showing effect of resistance in a motor circuit. I is for full voltage; curves 2, 3 and 4 show the effects of one step of resistance and 5 shows the torque distribution as improved by the use of compression resistors

The impedance type of starter has advantages over the auto-transformer starter because the motor is not disconnected when switching from the starting to the running position. The use of the impedance starter, however, reduces the power factor of the starting current and thus aggravates the condition that produces voltage fluctuations, which are objectionable and should be eliminated when a large number of induction motors are frequently started and stopped in normal service.

The fourth method of starting is the use of the primary resistance starter by which current limiting resistors are connected in series with the stator windings of the motor in starting. When these risistors are of the graphite compression type, they eliminate the high current inrush when the motor is first connected to the line.

The voltage across the motor terminals during the acceleration of the motor is gradually increased as the starting current decreases thus bringing the motor voltage practically up to the line voltage before the motor is switched to the running position across the line. In this switching operation the motor is changed from the starting to the running connection without opening the primary circuit so that there is no second current inrush as in the case of the compensator method of starting. When the graphite compression resistor is used, the starting resistance is introduced at a fairly high value and then reduced slowly until the current is sufficient to start the motor. This permits very smooth and uniform acceleration of the motor and provides a start that is slow and gradual without sudden jerks to machines. This slow and uniform acceleration prevents belt slippage and strains on gears or other methods of connecting the motor to the machine.

In Figure 2 torque curves are shown for the three most used methods of starting induction motors. With the compensator (curve I) the motor terminal voltage cannot rise until the compensator is switched to the full line voltage. Therefore, the starting torque does not rise quickly. In the case of the resistance starter (curve II) the motor terminal voltage rises as the motor accelerates causing an increasing torque as the motor comes up to speed.

(*Continued on page 66*)

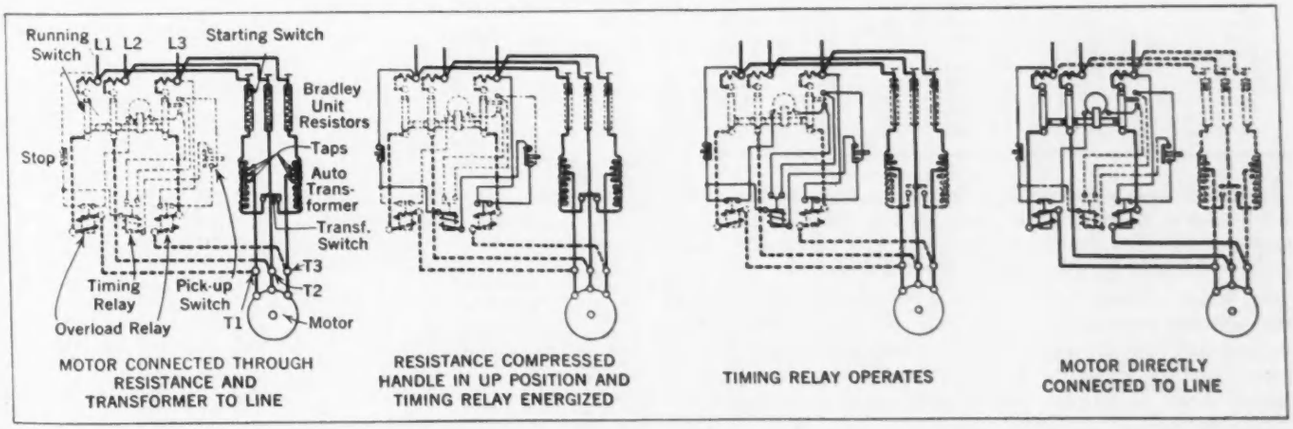


Figure 4

ABOVE are shown four steps in the operation of a resistance-transformer starter. The diagram at the left shows the motor connected through resistors and a transformer to the line. In the second diagram the same connections are shown except that the resistors are compressed and the current to the motor is increased. The third diagram shows the timing relay closing the running switch, and the fourth shows the motor running across the line with resistor and transformer disconnected

Business Conditions as Reflected in Average Wage Earnings

The stability of wage rates as reflected in average earnings per hour shows a tendency to resist the influence of fluctuations in business activities

ONE of the most significant economic changes in American industry during the past decade has been the changed relationship between the course of general business conditions and that of wage earnings, according to the National Industrial Conference Board.

The wage situation has been hailed both as a cause and a result of continued industrial prosperity in the United States, but its most significant phase, in the view of the Conference Board, is to be found in the remarkable stability of wage rates as reflected in average earnings per hour, which for some time have shown an increasing tendency to resist the influence of ordinary fluctuations in business activity. Whereas in former years a slowing up of activity almost invariably made itself felt in declining wage rates, and increased business activity was likely to result in rising rates of pay, average hourly earnings per worker in the manufacturing industries during the past five years have been practically unchanged. Hourly earnings per worker in 25 major branches of manufacturing during 1924-28 from month to month on the average have varied by only two cents between the highest and lowest points, and by only one cent during the 12 months of 1928.

Condensed Data on Wages, Hours and Employment, All Wage Earners, 25 Industries

Period	Average Hourly Earnings	Average Weekly Earnings	Index Numbers "Real Earnings"		Index Numbers of Employment, June, 1920-100	Average Actual Work Week for Wage Earner
			Hourly	Weekly		
1914						
July	$.245	$12.54	100	100	....	51.5
1928						
January	.568	27.22	142	133	79.1	47.9
February	.567	27.35	143	135	80.8	48.0
March	.570	27.59	145	137	81.2	48.2
April	.570	27.19	145	135	80.7	47.4
May	.567	27.23	143	134	81.2	47.8
June	.570	27.30	145	135	81.1	47.7
July	.568	27.09	144	134	81.8	47.5
August	.570	27.35	144	135	82.1	47.9
September	.574	27.76	143	135	83.0	48.2
October	.576	27.76	144	136	82.9	48.0
November	.573	27.42	144	135	81.9	47.8
December	.572	27.73	144	136	83.3	48.5

Average weekly earnings, reflecting as they do part time work and a shorter work week during slack seasons, as well as longer hours during busy periods, naturally show proportionately greater fluctuation, which, for the five year period 1924-28, however, amounted to only about $2.67 between the extremes, and to only 67 cents between the highest and lowest month of 1928. During the same period other factors affecting business conditions, particularly money rates, underwent considerably greater disturbances.

"Under present economic conditions, no radical change in rates of pay is likely to occur without radical changes in the business situation" says the Conference Board in a study of "Wages in the United States in 1928," just completed. "Such business changes as have occurred in the last few years have brought about, at best, a slight augmentation, at worst, a slight decline in business activity, whose effects, so far as they are traceable in the labor situation have affected more the hours of work and the volume of employment than they have the rates paid for labor."

Relating wage earnings to the movement of retail prices of such articles as generally enter into the wage earner's cost of living, the Conference Board finds that the purchasing power of an hour's work in the manufacturing industries for the year 1928 on the average was from 42 to 45 per cent greater, and that of the weekly pay envelope from 33 to 37 per cent greater than in 1914 in spite of the increase in living costs since that time, and also in spite of the fact that the average work week in 1928 was 48 hours as against 52 hours in 1914.

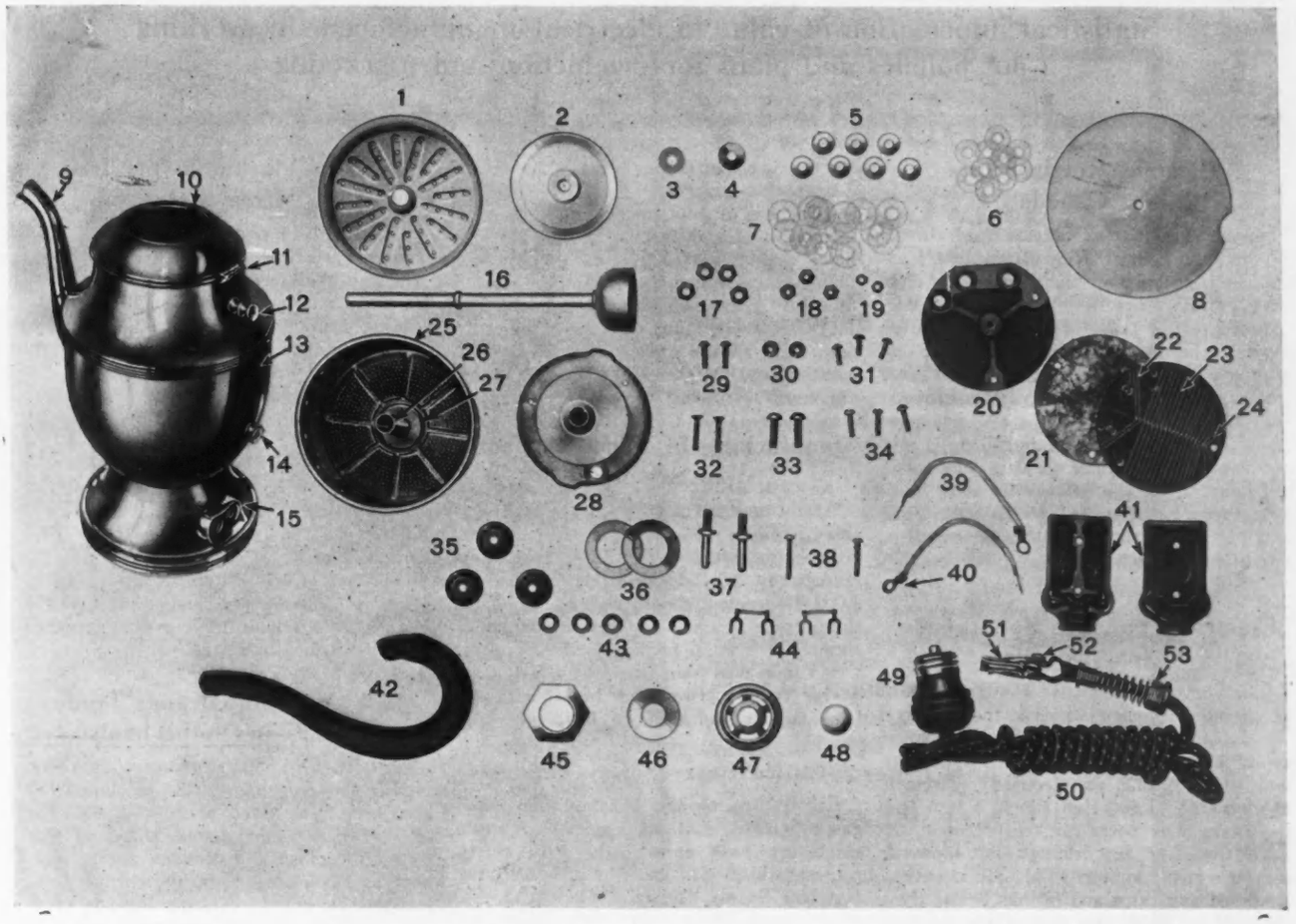
The following table presents the monthly changes in average hourly earnings per worker, average weekly earnings, "real earnings" per hour and per week, the average actual work week and the index numbers for employment in 25 major branches in manufacturing for the year 1928. The figures here given for hourly and weekly earnings, however, represent averages and take into consideration the entire range from the highest to the lowest of the earnings of skilled and unskilled, of male and female workers combined, and thus are not directly comparable with cost of living data expressed in dollars and cents.

In the electrical manufacturing industry for 1928, the average earnings per wage-earner of all wage-earners, that is skilled and unskilled, male and female workers combined, were 45.9 average hours per week per wage-earner; $0.615 average hourly earnings and $28.25 average weekly earnings.

Average Hourly and Weekly Earnings, All Wage Earners, by Industries, 1928

Industry	All Wage Earners		
	Average Hours per Week per Wage Earner	Average Hourly Earnings	Average Weekly Earnings
Agricultural Implement	49.9	$.625	$31.16
Automobile	47.9	.683	32.67
Boot and Shoe	43.9	.493	21.64
Chemical	50.4	.565	28.51
Cotton—North	46.9	.420	19.66
Cotton—South	43.8	.316	13.85
Electrical Manufacturing	45.9	.615	28.25
Furniture	47.0	.544	25.58
Hosiery and Knit Goods	46.8	.464	21.72
Iron and Steel	54.3	.646	35.13
Leather Tanning	45.2	.543	24.54
Lumber and Millwork	47.6	.554	26.39
Meat Packing	50.6	.511	25.90
Paint and Varnish	50.8	.566	28.72
Paper and Pulp	50.8	.534	27.12
Paper Products	47.5	.523	24.87
Printing—Book and Job	46.2	.688	31.76
Printing—News and Magazine	45.2	.865	39.08
Rubber	46.0	.650	29.92
Silk	48.4	.483	23.36
Wool	44.5	.489	21.76
Foundry and Machine Shop	48.3	.596	28.79
(1) Foundries	49.2	.607	29.85
(2) Machines and Machine Tools	49.3	.608	29.99
(3) Heavy Equipment	47.7	.657	31.34
(4) Hardware and Small Parts	47.5	.542	25.72
(5) Miscellaneous	47.4	.582	27.57

Electric Percolator Parts



ELECTRICAL MANUFACTURING *acknowledges the assistance of the Beardsley & Walcott Manufacturing Company, of Waterbury, Conn., in the preparation and presentation of this table and illustration of electric percolator parts and components. The illustration is made up of the principal parts of the percolator, while the table contains the names of the principal parts of the device and the names of the various materials from which they are manufactured*

Table of Parts and Raw Materials Used in Electric Percolators

Part No.	Title	Material	Part No.	Title	Material
1	Coffee container cover	Aluminum	28	Sub-base	Aluminum
2	Cover	Glass	29	Screw	Steel
3	Washer	Fibre	30	Thumb nut	Brass
4	Washer	Brass	31	Screw	Brass
5	Washer	Steel	32	Screw	Brass
6	Washer	Mica	33	Screw	Steel
7	Washer	Mica	34	Screw	Brass
8	Bottom plate	Steel	35	Feet	Wood
9	Spout	Copper	36	Washer	Aluminum
10	Lid	Copper	37	Contact post	Brass
11	Hinge and pin	Brass	38	Screw	Brass
12	Handle lug and screw	Brass	39	Wire	Copper and insulation
13	Percolator body	Copper	40	Contact	Copper
14	Handlle lug and screw	Brass	41	Insulating member	Molded insulation
15	Base	Copper	42	Handle	Wood
16	Tube and base	Aluminum	43	Washer	Steel
17	Nut	Brass	44	Fuse	Copper and fuse wire
18	Nut	Brass	45	Nut	Aluminum
19	Nut	Brass	46	Washer	Aluminum
20	Heating plate	Cast iron	47	Nut	Aluminum
21	Insulating disc	Mica	48	Knob	Brass
22	Heating element anchor	Brass	49	Plug	Brass and insulation
23	Heating element	Resistance wire	50	Cord	Copper and insulation
24	Heating element disc	Mica	51	Contact	Brass
25	Coffee container	Aluminum	52	Contact screw	Brass
26	Coffee container tube	Aluminum	53	Guard	Wire and wood
27	Washer	Aluminum			

Facts, Figures and Trends

Statistical information of value to electrical manufacturers in working out policies and plans for production and marketing

Electric Refrigerators in Canada

As the result of a canvass made in the Fredericton district, New Brunswick, Canada, it is found that the demand for electric refrigerators is steadily increasing. There are two types of such refrigerators now on the market, both of American origin, one being imported from the United States and the other being manufactured in Canada. The prices of these machines vary from $250 to $1,000, installed. Should a manufacturer be able to place an electric refrigerator on the market at about one-half the price of those now on sale, there is little doubt that there would result a good demand in the city of Fredericton.

Electric Appliance Supervision in Australia

The State Electricity Commission is preparing recommendations to the Ministry for amending legislation to provide wider power over the sale and use of apparatus and the licensing of electricity wiremen and others. Legislation which it is hoped to obtain will cover the enforcement of regulations for the testing and approval by competent authority of all domestic electrical apparatus and fittings before they are sold or used, also testing the manner in which they are connected.

Consumption of Electricity in Great Britain

Consumption of electric current in Great Britain totaled 7,602,000,000 kw-hr. in 1928, an increase of 750,000,000, or 10.9 per cent, over 1927, according to returns recently made to the Electricity Commissioners by the authorized supply undertakings, including private companies and municipal plants. The consumption of electricity in Great Britain has more than doubled in the last six years, the 1928 figure comparing with 3,645,000,000 kw-hr. in 1922.

525 Million Electric Lamps Sold in 1927

According to the report of the lamp committee of the National Electric Light Association at its recent convention, 525,000,000 electric lamps of all kinds were sold in the United States in 1927.

Of these, 305,000,000 were the large tungsten filament lamps, such as are used generally in lighting, an increase of 3.7 per cent over 1926, and 12,600,000 were the large carbon filament lamps. The sale of carbon filament lamps shows a decrease of nearly 32 per cent over the previous year. Of these carbon lamps, about 22 per cent were of domestic manufacture and 78 per cent imported.

The sale of miniature lamps amounted to almost 220,000,000. Of this number, more than 205,000,000 were the tungsten filament and about 14,500,000 the carbon filament. Automobile lamps amounted to 116,500,000 and Christmas tree lamps of both tungsten and carbon filaments amounted to almost 59,000,000. Flashlight lamps amounted to 37,000,000.

Manufacture of Electric Lamps in Sweden

At the annual meeting of the Cooperative Union (Kooperativa Fordundet), Stockholm, which was held in Stockholm recently, it was decided that a fund of 2,000,000 crown should be set aside for the purpose of financing the building of an incandescent lamp factory. The Cooperative Union now owns and operates a margarine factory, two flour mills, a rubber shoe factory and artificial fertilizer plant.

Utilities Enter Safety Contests

Eighty-three electric light and power and gas companies, each having 1,000 or more employees, have entered the 1929 safety contest which will be conducted by the National Safety Council. These contests, which began Jan. 1 and will continue until June 30, are being held for the purpose of enlisting the spirit of competition in the effort to reduce accident frequency and severity. Trophies will be presented to the winners at the Eighteenth Annual Safety Congress, which will be held in Chicago, Sept. 30 to Oct. 4.

Increase in Fuel Savings by Utilities

Since 1929 the electric light and power industry in this country has saved approximately 180,000,000 tons of coal through improved facilities, larger units, interconnection and greater efficiency. In 1919 it required nearly 3¼ lb. of coal to generate a kilowatt hour of electrical enrgy. This had dropped to 2½ lb. by 1922, and in 1928 it had decreased still further to 1¼ lb.

Radio Sales in First Quarter of 1929

Reports from 7581 dealers, received by the Electrical Division of the Department of Commerce in connection with its survey of dealers' radio stocks for the first quarter of 1929, indicates sales of $25,540,245, as compared with $37,975,015 representing sales by 6569 dealers in the fourth quarter of 1928, and $20,508,666 by 8289 dealers in the third quarter of 1928. From January to March inclusive 139,347 electric and 15,623 battery sets were sold.

Radio Market in the Irish Free State

The Dublin broadcasting station (2RN) started broadcasting on its new wave length of 411 meters on Jan. 13, 1929, the former wave length being 319.1 meters. This change was effected as a result of the redistribution of wave lengths by the International Union of Radiographie. It is understood that the new wave length is more successful than the previous one in use.

The market for wireless sets continues to be fairly active, and at the close of December, 1928, there were 26,000 licensed holders of radio sets in the Irish Free State. The programs broadcast by the Dublin and Cork stations continue to be improved, but the principal interest of the listeners-in continues to be in the numerous British broadcasting stations.

U. S. Vacuum Cleaner Trade Wanes in Netherlands

Imports of vacuum cleaners into the Netherlands during 1928 amounted to $1,274,000, compared with $990,400 for 1927. The United States' share of this trade showed a slight decrease due to competition encountered from the cheaper German and Swedish machines, imports from both of these countries showing substantial increases.

Value of 1928 Imports Lowest in Four Years

Imports to this country in 1928 totaled $4,091,000,000, $93,600,000, or 2.2 per cent below the 1927 figure; 34.1 per cent of imports were dutiable and were valued at $1,393,469,000, while the balance came in free of duty. Duties collected totalled $565,501,000.

Telephones in Japan

In Japan the number of telephones is strictly limited by the government telegraph authorities, in order to prevent overtaxing the central office equipment and probably for other reasons. To obtain a telephone requires registering an application and waiting for perhaps one or two years until the applicant's turn on the waiting list comes.

Cost of Household Electricity

About $2.40 a month, or $28.30 a year, is the amount spent by the average American family for enough electricity to comfortably light the home and operate several labor-saving electrical devices, such as the iron, vacuum cleaner, toaster, and fan, according to statistics gathered by the National Electric Light Association.

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Census of Distribution

(*Continued from page 21*)

companies by automobile dealers in financing installment sales and the prevalence of the use of standard terms in such sales; and the high percentage of "returns" and "allowances" on ordinary charge-account sales among department stores. We learn, by the returns from 440 department stores doing a total volume of business of nearly 1 1-3 billion dollars, that approximately two-thirds of the sales are for cash and one-third for credit. In the year 1927, 27 per cent was on open credit (regular charge accounts), while 6.1 per cent represented installment credit.

I think you will readily agree that these are concrete facts of unquestionable utility to the "hard-boiled" man of business. It is such facts as these, on a tremendous nation-wide scale, that we shall endeavor to obtain in the 1930 Census of Distribution.

It is impossible to overestimate the advantages that a man of judgment and penetration can derive from the study of business facts. He should insist on them inexorably —like the farmer in the story that Assistant Secretary of Commerce Julius Klein likes to tell. This farmer was listening to a futile argument as to whether one should say, of a hen, that she is "sitting" or is "setting." Finally he lost all patience and cried out: "That subject you're discussin' don't int'rest me a-tall. What I want to know is: when I hear a hen cackle, is she laying or is she lying?" That worthy agriculturist was a devotee of facts.

Because of my own profound conviction of the value of the Distribution Census of 1930, I take this occasion to urge American business men everywhere to cooperate fully with the Government and with their fellow business men in making the enumeration a success. The benefits they will derive from such cooperation are obvious.

Leagues Hear Plan

(*Continued from page 24*)

to do market development efficiently, without needless expense.

The total enrollment of 199 at Camp Cooperation IX included representatives of 58 local leagues, compared with 49 in 1928 and 33 five years ago. Held under the auspices of the Society for Electrical Development and the League Council, the business sessions brought out a variety of discussions as to the theory and practice of leagues, both in relation to local industry problems and in connection with market development problems.

Keen interest was shown in the S. E. D.'s complete announcement of the new companion-piece to the Red Seal Plan—the Franklin Specification for Industrial and Commercial Interiors, and also in the selling helps now available to leagues prepared to undertake this activity. More than 38,000 Franklin specification booklets have been purchased by power companies, leagues, wholesalers and others. Of more than a third of a million Franklin sales letters placed on sale June 5, more than 40 per cent have been taken up by leagues and power companies.

League managers were cautioned to use this specification only after a most careful study of their own resources and market. The authority to operate the plan is vested in the S. E. D. and license may be applied for by leagues or central stations. The plan being predicated on a close knowledge of the lighting market as encompassed by stores, offices and factories, no promotional stone has been left unturned in setting up the operating material. S. E. D. headquarters now has available licensing forms, specifications, certificates of award, two colored illustrated sales letters and a coordinated operating manual.

League managers reported gains all along the line in Red Seal installations and market development work, and broad interest in Christmas lighting, home modernization, food preservation programs and Light's Golden Jubilee.

Making an Electrical Product

(*Continued from page 34*)

Cameron Company can produce any kind of commutator in a minimum length of time.

To further this one outstanding feature the plant or factory of the Cameron Company is adequately equipped and carefully arranged for quantity production at low cost. Practically the entire business of manufacturing commutators is carried on in the three-story building shown at the right of the illustration appearing on the first page of this article, although most of the building at the left of the illustration is also occupied but principally for other work.

On one floor and near the front of the principal factory building are the receiving and shipping departments, these being equipped with the usual facilities. Adjacent to these sections and on the same floor is the screw machine department. In it is a number of both large and small screw machines of various makes, that are used for manufacturing many of the parts used in commutator production.

In the rear of these two sections of the plant is a large department in which are to be found a number of power presses, saws for cutting copper bars into segments and hand saws for cutting the inner and outer edges of the segments to the desired shapes or forms.

The second floor, except for space occupied by the offices, is again divided into departments. In one of these is grouped all of the heavy-duty lathes which are used for boring and turning assembled commutators, as well as the machining of the commutator cores. In the same section with the heavy lathes are benches upon which workmen assemble the segments of the heavy commutators.

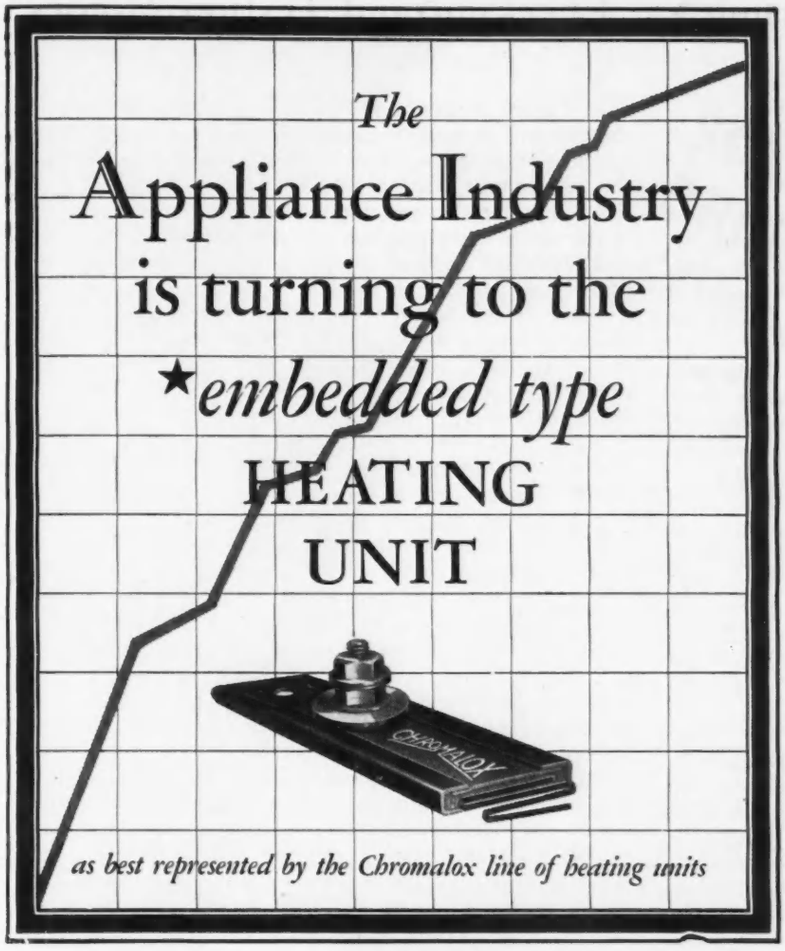
Adjoining this department and on the same floor is a section of the shop equipped with many kinds of machine tools and a number of work benches. The tools consist of light engine lathes and light milling machines for finishing the smaller types of commutators—and other lathes and millers for the heavier work. The benches are used for applying the connection pieces to the commutator bars as well as for inspection and testing operations.

Part of the third floor is devoted to the production of insulation and to do this there are saws and shears for cutting the materials as well as the different forming presses and heating devices required. All of the small commutators for the lighter types of electrical apparatus and those for automotive starters are also assembled on this floor.

Since in the replacement of commutators on motors and generators there are many other repairs to be made, the Cameron Company is fully equipped to handle this work, although it is but incidental to the regular business. Facilities for motor and generator repairs are located on the third floor of the building at the left of the principal factory building. These, while more extensive, are similar to those to be found in any conventional motor repair shop. They include, of course, coil winding, taping and spreading machines, with the usual test apparatus, dipping tank and baking oven.

Adjacent to this section of the shop is a large group of different types of machines that are auxiliary to those in the main plant. They are used primarily on the smaller products.

Other information and a number of views of different sections and operations in the Cameron Electrical Manufacturing Company's plant are to be found elsewhere in these pages, in an article entitled "Commutator Production."



This chart shows the trend of leading appliance and industrial equipment manufacturers towards adopting Chromalox embedded type heating units. Today, more than 90 electrical manufacturers are making their products trouble-free by standardizing on patented Chromalox heating units.

REASONS: Because, as manufacturers and dealers and central station commercial managers will tell you, Chromalox heating units have definitely helped to eliminate heating unit problems. Of patented construction (having the resistor wire embedded in refractory) these Chromalox units have enabled many an appliance manufacturer to finally put on the market products that are trouble-free as far as the heating element is concerned.

Chromalox-equipped, A Vital Selling Point

"Chromalox-equipped"—that in itself is a definite guarantee that such appliances will give your customers the best of performance service. That's why manufacturers such as Majestic Elec. Appliance Co., Wells Mfg. Co., Armstrong Elec. & Mfg. Corp., American Ironing Machine Co., play up the fact that they use Chromalox units. It's a convincing selling point. It means that you and your dealers won't be bothered with the usual kicks and comebacks that put you in wrong with customers, and eat into your profits.

Chromalox-equipped Products STAY SOLD

Most of the guess work about your product doing a real job can be easily eliminated by using Chromalox units. Automatically, kicks and comebacks are side-tracked when you use these trouble-free units.

But What About Your Products?

Whether you are working on a new product or improving an old one, we can be of valuable help to you with experience gained from years of working with leading companies making all kinds of electrically heated equipment. When you write for the Chromalox bulletins, tell us about the appliances or heating devices you want properly heated. There's no obligation!

Write for your copy of these 8-page bulletins showing dozens of sizes and ratings of the largest complete line of heating units for all kinds of electrical appliances, heating devices, hotel and restaurant equipment and other electrically heated products.

This thoroughly modern day-light factory now nearing completion, will be devoted to the manufacture of Chromalox heating units

★Chromalox
ELECTRIC HEATING UNITS

Manufactured Exclusively by Edwin L. Wiegand Company, 7500 Thomas Boulevard, Pittsburgh, Pa.
SOLE LICENSEES: Canadian Chromalox Co., Ltd., Toronto, Can. ABROAD: Geo. Bray Co., Leeds, England

The Appeal in Advertising

(*Continued from page* 45)

> ground that women do not enjoy their occuptation. If women did not enjoy housework it is unlikely that they would continue to do it in the measure that they do. Men, disliking it, have simply not done it.

And to quote still further, only this time from a report by the J. Walter Thompson Company, it came out that of the women interviewed 54 per cent were not at all interested in doing more of their work electrically, while the remaining 46 per cent did not exactly fall over themselves in unbridled enthusiasm at the idea.

Where, R. S. W., did you collect the notion that women are "creators?" They aren't. They never have been. Whether they ever will be is something I can't foretell. To date there has never been a truly great female creative or inventive genius. Some of them have approached greatness, but they have never attained the heights. Practically all our famous women have been either actresses or courtesans—they have not been authors, painters, musicians of scientists. You've got procreation mixed up with creation. And the business of producing children requires so little intelligence and creative effort that it is better not to think about it. If women can be called creative on the basis of their child-producing ability, then guinea pigs must be the Edisons of this earth.

Another thing! Where did you get the idea that housework doesn't "show?" Granted that housework is an occupation where you get nothing if you do it and are censured if you don't, just go into a house where the tasks haven't been done and see how you like it. It's a negative thing rather than positive, I'll admit, but not making beds and not washing dishes are the most showing things I know.

I'm honestly sorry I brought up that delicatessen matter. I admit that it has its weak points once you get outside the city. But, surely even in the smallest town, they have canned goods—edibles that are frequently cheaper than the fresh—and it is still legal to sell can openers.

From R. S. W.'s attitude toward the fondness of men for martyrs I judge that he is not married. If he had to come home, night after night, to a woman who greeted him with a sigh and told him, in detail, how dead-tired she was, how exhausted she was, how bad the children had been, how late the grocer had been, how Mrs. Jones had a new hat that was prettier than hers, and how the tap in the bathroom leaked, I think he would soon get over the idea that martyrizing is an endearing trait.

Unpleasant as it is to have a martyr about I wouldn't say a word if, as R. S. W. intimates, they used their martyrdom as a lever to get for themselves the electrical equipment we all wish they would want. But they don't. They don't martyrize for any constructive reason at all. They do it for nothing, or for fun. And if you want them to keep on with it, you are probably the only man in the world who does.

Because a woman ceases to be a martyr doesn't mean that she will cease to be a woman. There's a whale of a difference between being a martyr and just going out after what you want. A woman can catch a lot more of this world's goods by keeping her lips rouged and her hair waved than she can by complaining and letting her hands get calloused—and when more women realize it there will be more electric equipment sold. It all resolves itself into the problem of convincing them that it will pay them to be women instead of beasts of burden, human beings instead of martyrs. We must show them that electric equipment will pay dividends—higher dividends than the satisfaction of feeling oneself an object deserving of pity, condolence and "appreciation!" And, it is my opinion that this cannot be done by appealing to woman's martyrdom.

Checking and Testing Motors

(*Continued from page* 59)

In Figure 3 speed-torque curves are shown illustrating the effect of primary resistance in the stator circuit during starting of a motor. Curve 1 is the speed-torque curve for full voltage starting. Curves 2, 3 and 4 are for one fixed step of resistance used in the motor circuit. Curve 5 is the result when graphite compression resistance is used and steplessly reduced as the motor accelerates. These curves show that it is possible to control the torque distribution during the starting period of a squirrel cage motor so as to bring it up to speed with the least strain on the motor windings, lease shock on the driven machine and practically no disturbance to the power supply circuit. It should be noted that the peak torques in Figure 3 all occur at about 85 per cent or normal speed. This shows that the general torque characteristic of the squirrel cage motor is not changed through inserting resistance in the stator circuit and that only the maximum torque value is reduced with a favorable distribution of the torque during the starting period.

Figure 4 shows four steps in the operation of a resistance-transformer starter. The four methods of connection illustrate its different functions.

Resistance-Transformer Starting. — There is another method of starting squirrel cage motors which combines the use of a primary resistance and a transformer. As already pointed out the auto-transformer requires an excessive exciting current inrush to magnetize the core when it is first connected to the line. In this combination resistance-transformer starter this first inrush is prevented by connecting the transformer to the line through graphite compression resistors. These resistors reduce the first current inrush from the line to less than normal full load motor current. The gradual reduction of the primary resistance by compressing the discs in the graphite compression resistors slowly increases the current to the motor from the transformer until the motor accelerates. During this interval the transformer reduces the starting current drawn from the line in proportion to the transformer ratio.

When the motor reaches sufficient speed, the transformer which up to this point has been connected in open delta, is disconnected at the common point leaving the motor connected to the line through the graphite compression resistors and the impedance of the transformer. The next step connects the motor through the running switch to the line and the final step disconnects the transformer from the line. The second current inrush as in the case of the auto-transformer, is limited to a value which can do no harm to the line voltage because the motor is not disconnected when switching to line voltage.

The main feature of this type of starter is the reduction of the line current in proportion to the transformer ratio. This makes possible the installation of large squirrel cage motors on power lines which otherwise could not handle them without excessive line and transformer capacity. The auto-transformer used in this type of starter consists of two coils in open delta with three starting taps on each coil arm. By interchanging two flexible leads on a terminal strip, it is possible to provide a transformer ratio of 55, 62 1/2 or 80 per cent, giving a wide range of starting torque adjustment. When this starter is used on motors subject to wide load variations, the starter taps can be set high enough to take care of the worst condition and the graphite compression resistors will keep the starting current lower than in the case of an auto-transformer starter of the same ratio. This type of starter is of particular service in the handling of hard starting loads requiring considerable time to come up to speed when other types of starters are used.

SCREW MACHINE PRODUCTS that reflect integrity ..... *consistently*

The value to you of specialized co-operation has been proven in many ways—has it been proven in the case of machine parts?

Each of us has his own part to do in eliminating waste in production, and ours is the vital one of furnishing screw machine products by the million—accurate, durable and uniform.

You will find our service and facilities equal to any problem you have. Just send us samples or blue prints and let us quote prices. From 1-16″ to 3″ in iron, steel or brass.

SAMUEL J. SHIMER & SONS
Milton, Pa.

Send for catalog

The Appeal in Advertising

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SAMUEL J. SHIMER & SONS
Milton, Pa.

Send for catalog

Electrical Manufacturing News

A department containing news, and descriptions of new materials, parts and devices for the manufacture and repair of electrical products

Refrigeration Men Condemn Destructive Advertising

Urging dealers and distributors to avoid discussing the relative merits of refrigerants, members of the Refrigeration Division of the National Electrical Manufacturers Association unanimously adopted a resolution condemning destructive advertising and selling methods at a meeting held in Cleveland early in August.

The resolution passed by the Nema division reads as follows:

Whereas, the manufacturers of mechanical refrigerators are collectively interested in creating the largest possible group of prospective purchasers of their product and to share in the business so created according to their individual merits and,

Whereas, any expedient that may be adopted by individual manufacturers which may cause the public to question the merits of mechanical refrigeration of any type and thereby tend to diminish the total volume of refrigeration sales is harmful to the industry generally and in the last analysis to the individual manufacturers.

Therefore, Be It Resolved that the Refrigeration Division of Nema does not approve selling or advertising policies or any other expedient which encourages discussion of the relative merits of the various types of refrigerants and,

Be It Further Resolved that the members of this organization will use every means at their disposal to urge their distributors and dealers and all employees of such organizations to act according to the spirit and the letter of this resolution.

Safe Sailing Now for Small Craft

NEW radio apparatus designed to make the sea safe for small craft has been developed by Dr. F. A. Kolster (left) of the Kolster Radio Corporation. Radio beacons in harbors all over the world periodically send out warning signals, and heretofore these safeguards have been limited to the larger boats and ocean-going steamers. Now, however, pleasure yachts and the smaller craft may also reap the benefit of radio's ever-watchful eye

Arlington Bensel Joins Gilby Wire Co.

Arlington Bensel, for over twenty years sales manager and vice-president of the Driver-Harris Company, Harrison, N. J., has been appointed vice-president and sales manager of the Gilby Wire Company, Newark, N. J., manufacturer of nickel chromium, copper-nickel and other alloys.

Arlington Bensel

Mr. Bensel, a native of Newark, was for twelve years engaged in the lithographing, printing and direct mail advertising business in New York. In 1895 he entered the employ of the Driver-Harris Company as sales manager and was connected with that organization until 1926. He was first vice-president of that company during the last ten years of his association there.

Mr. Bensel has been placed in charge of the sale of all Gilby products.

Potential Market Chart Issued by Commerce Department

A table showing the potential market for American products in countries over the entire world has been prepared for American manufacturers by the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Department of Commerce. The compilation gives the population of the country, the total number of persons of European origin residing in the country, the comparative purchasing power of persons of non-European origin expressed in units of the resident European population, the political sentiments in so far as they influence the desire to buy and sentiment favorable to American as opposed to goods of other foreign origin, and the effects of climatic conditions, habits and customs, and domestic production as they influence the desire to buy.

Copies of the table may be procured by addressing Marshall T. Jones, Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Department of Commerce.

Refrigeration Safety Code Nears Completion

A complete refrigeration safety code is now being drawn up and will soon be submitted for approval to the American Standards Association, says a recent statement by Leland P. Bannister, merchandising adviser, Refrigeration Division, National Electrical Manufacturers Association. Mr. Bannister recently outlined the activity of the refrigeration industry following the Chicago accidents which were ascribed to the escape of gases from electrical refrigerators.

The drafting of a safety code was the first organized effort of the refrigerator manufacturers immediately after the formation of the Nema Refrigeration Division last May. The drafting of such a code naturally involved considerable engineering research and investigation. The code was almost completed when the Chicago mishaps occurred.

New York Power Show Will Run Week of December 2

Plans are well under way for the eighth National Exposition of Power and Mechanical Engineering at Grand Central Palace, New York City, opening Dec. 2 and continuing throughout the week.

The National Power Show, as the ex-

We can prove that silence is golden

In this noisy age, people more and more are demanding quiet in their homes. And the manufacturers of electrical household appliances who are getting the lion's share of the public's purchases are those whose devices operate most noiselessly. If you would call the roll you would find that a surprising number of them—vacuum cleaners, phonographs, washing machines, dishwashers, oil burners, home movie projectors and organs—are powered by Robbins & Myers units. Operated day in and day out with little or no attention, it is only the exquisite precision of their construction which makes it possible for these R & M units to run smoothly and quietly for years. Indeed, many of our oldest and most successful customers are frank to admit that no small part of the prestige of their product has been won by the time-defying quietness of its R & M power plant.

If you have a problem in electrical-motored machinery come to Robbins & Myers. We offer you the facilities of a completely modern plant, and the experience of 31 years' precision manufacture in designing, building and applying electric motors, generators, fans, and electrical appliances

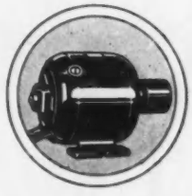
Partial List of Apparatus to which Robbins & Myers Motors have been successfully applied

Adding Machines	Confectioner's Machinery	Humidifiers	Movie Projectors
Advertising Displays	Conveyors	Ironing Machines	Portable Tools
Air Compressors	Dental Lathes	Labeling Machines	Printing Presses
Baker's Machinery	Dish Washers	Oil Burners	Spray Equipment
Blowers	Driers	Office Appliances	Ticket Selling Machines
Brick Machinery	Floor Surfacers	Organ Blowers	Vacuum Cleaners
Churns	Folding Machines	Mailing Machines	Ventilating Fans
Cloth Cutters	Heaters	Machine Tools	Unit Heaters
Coffee Mills	Heat Regulators	Meat Choppers	Washing Machines
Coin Counters	Hoists	Milking Machines	Wrapping Machines

Robbins & Myers, Inc.

Springfield, Ohio **Brantford, Ontario**

1878



1929

position has come to be more briefly known, has become a national institution since its inception in 1922 when the attendance was only 47,589. Last year's attendance rose to 123,000 and the number of exhibitors made the phenomenal showing of 542 in 1928 as against only 105 in the first year of the exposition.

From a list of over 400 corporations which have already reserved space, this year's exhibits may well be grouped into three general classes: first, new developments, comprising new inventions, new processes and new ideas; second, improvements on old principles and third, those grouped under engineering staples.

Coincident with the National Power Show, the American Society of Mechanical Engineers will hold its annual meeting in New York City.

Harold Smith, Vice-President of Westinghouse Co.

At a recent meeting of the board of directors of the Westinghouse Electric & Manufacturing Company, held in New York, Harold Smith, general solicitor of the company, was elected vice-president. His office will be in the Westinghouse Building, 150 Broadway, New York City.

Harold Smith

Mr. Smith entered the Legal Department of the Westinghouse company in 1919 and was appointed general solicitor in 1926. Prior to that time he was engaged in the practice of law in Chicago, being a member of the firm, Glennon, Cary & Walker. He is a graduate of Northwestern University (L.L.B. in 1905) and at Yale (L.L.M. in 1906), and he also studied at the University of Chicago. He is a member of the bar of the States of New York and Illinois.

Inca Mfg. Corp. Will Manufacture Line of Copper Wire Products

George A. Jacobs, founder and former president of the Dudlo Manufacturing Company and his associates have organized the Inca Manufacturing Corporation at Fort Wayne, Ind., to manufacture copper wire products for the electric, radio and kindred industries. Offices have been established and construction of a large plant is under way on the eleven acre factory site which has been purchased. It is expected that the plant will be in actual production within a few weeks.

Officers of the Inca Manufacturing Corporation are: president, George A. Jacobs; vice-president, Wendall C. Glass; secretary-treasurer, George A. Spindler, and S. A. Jacobs in charge of sales. The first unit of the factory now nearing completion covers an area of 200 by 300 feet and will afford immediate employment for about 500 workers.

Thomas E. Murray, Inc., Elects J. H. Lawrence Head

John H. Lawrence, vice-president and manager of the company since its organization in 1919, was elected president of Thomas E. Murray, Inc., 88 Lexington Ave., New York, designing and consulting engineers, at a recent meeting of the board of directors. Thomas E. Murray, Jr., is chairman of the board and Joseph B. Murray and John F. Murray are vice-presidents.

Mr. Lawrence, a graduate of Cornell University, was associated with the late Thomas E. Murray in the engineering department of the New York Edison Company. When the latter organized his own firm he chose Mr. Lawrence as the head in charge. Among the many power plants designed under Mr. Lawrence's supervision are the East River Station of the New York Edison Co., the Hell Gate Station, United Electric Light & Power Co.

Radio Tube Merger Links Four Manufacturers

A new unit in the radio tube industry was created recently with the formation of the National Union Radio Corporation, the nucleus of which comprises four vacuum tube manufacturers—Sonatron Tube Company, Televocal Corporation, Marathon Company and Magnatron Company. The new corporation has an initial capitalization of $16,000,000.

National Union Radio Corporation has facilities for a daily production capacity of 75,000 to 100,000 radio tubes, it is reported, with five plants located in Chicago, Newark, Hoboken and Union City, N. J. An efficient nation-wide merchandising organization is now being developed.

"Talking with Sound Effects"

Here we have W. C. ("Bill") Grunow registering a short talk on movietone at the Grigsby-Grunow outing last month, which boasted an attendance of 32,000

Brevities

Pilot Tube & Radio Corporation, Brooklyn, N. Y., reports that it has concluded arrangements for the purchase of the Twin Coupler Company, Inc., Poughkeepsie, N. Y., manufacturer of radio frequency coils and kindred products.

Bakelite Corporation, 247 Park Ave., New York City, manufacturer of insulating products, composition rubber goods, etc., has acquired land at Bound Brook, N. J., and plans to start on its new $300,000 plant within a few weeks.

Gordon F. Carr, 135 Chapin St., Binghamton, N. Y., and associates have organized the Carr Home Appliance Company to operate a plant for the manufacture of electrical appliances and equipment.

Connecticut Telephone & Electric Company, Meriden, Conn., manufacturer of telephone equipment and electrical fixtures, in receivership for the past year, has closed its plant at Meriden and announces that it will be offered for sale at public auction shortly.

Day-Fan Electric Company, Dayton, Ohio, manufacturer of radio and electrical products, was reported to have merged recently with General Motors Corporation. The consolidation is to be effected by an exchange of stock, and it is reported that approval of the stockholders will be forthcoming very soon.

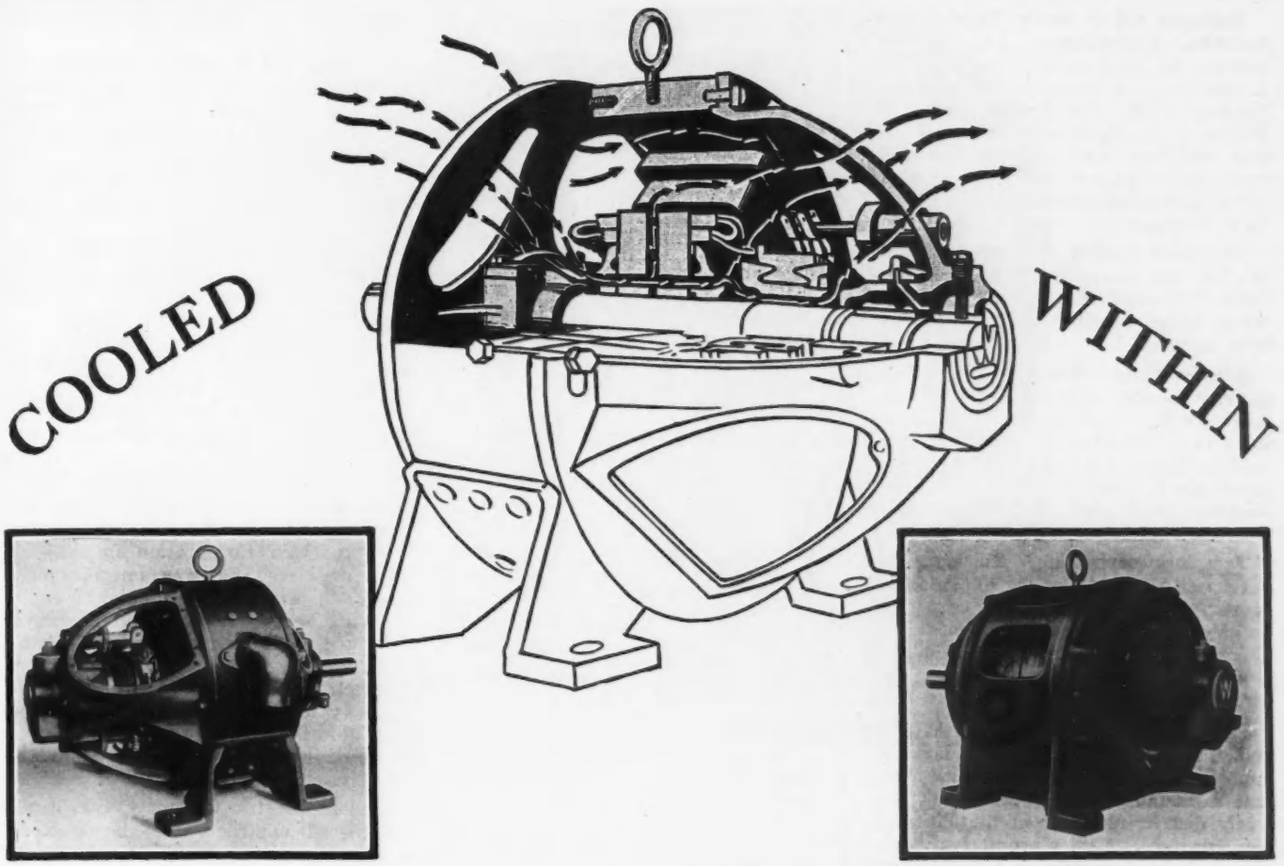
Kelvinator Corporation, Detroit, has issued several pieces of literature for use by its dealers and distributors in the National Food Preservation campaign. The literature includes a folder entitled "September, National Food Preservation Month—and What It Means to You"; a calendar for the month and an illustration of foods printed in color on the outside; and a broadside which used the Food Preservation Program essay contest as a keynote.

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has named as manager of the Electrical Department R. S. Fleshiem, to succeed J. R. Jeffrey, resigned. Mr. Fleshiem joined Allis-Chalmers soon after his graduation from the University of Michigan in 1904. He worked in the sales departments of various district offices from 1913 until 1917. After serving in the World War he was appointed assistant manager of the Electrical Department.

Nema Fall Meeting

The annual meeting of the National Electrical Manufacturers Association will be held at the Waldman Park Hotel, Washington, D. C., Oct. 7-12. The first trade practice conferences to be held in the electrical industry will be conducted during this meeting.

The tentative program for this meeting will be found on page 54 of this issue.



for more horsepower

IN order that you may have more horsepower per pound of material, Westinghouse engineers have given close attention to the cooling of electric motors.

Internal passages are provided through which air is circulated to the innermost parts of Westinghouse motors—for example, through the armature and under the commutator of d-c. machines. Air currents, set up by the built-in blowers, are scientifically directed, so that they will be most effective. Alternating-current machines, for instance have a curved steel plate inside the brackets to direct the air. Thus, the heat generated in the windings is dissipated, internal temperatures are kept low, and a lighter, more compact motor design is made possible.

Through unsurpassed research facilities, Westinghouse is able to provide a modern motor, suited to your needs.

Numerous well-equipped and efficiently-manned Service Shops throughout the country assure prompt SERVICE to the purchasers of Westinghouse products.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
EAST PITTSBURGH PENNSYLVANIA

SALES OFFICES AND SERVICE SHOPS IN ALL PRINCIPAL CITIES

Westinghouse

T 30760

Industrial Apparatus includes - -

Arc-welding Equipment
Automatic Switching
Babbitt and Babbitt Pots
Battery Chargers
Capacitors
Circuit-breakers
Electric Ovens
Instruments and Meters
Insulating Materials
Lighting Equipment
Locomotives
Mazda Lamps
Micarta Gears
Motors and Control
Panelboards
Safety Switches
Speed Reducers
Switchboards

Williams Oil-O-Matic Heating Corporation, Bloomington, Ill., has appointed as general sales manager W. J. Brevitt, assistant sales manager since January, 1928. Mr. Brevitt joined the Williams organization in 1925 as a field man and was soon promoted to sales promotion manager and later to manager in charge of sales in New York and New England.

Champion Switch Company, Kenova, W. Va., has moved its New York office from 2 Rector St. to 140 Cedar St., where increased space and facilities have been secured.

Bremer-Tully Manufacturing Company, Chicago, manufacturer of radio receivers has appointed B. R. Peacock sales representative for the New England territory. He formerly covered the northwest territory for American Bosch Magneto and also A. C. Sparkplug Company, division of General Motors.

Temple Corporation, Chicago, has purchased 186,000 sq. ft. of industrial property at the southeast corner of La Vergne Ave. and West 65th St., Chicago. This is to be improved with a new $500,000 plant covering four acres.

Steinite Radio Company, Fort Wayne, Ind., has announced the following new appointments: O. R. Coblentz, assistant sales manager; S. J. Helsper, formerly district manager in the Philadelphia territory, as sales promotion manager, with headquarters in Fort Wayne; Harold Weislow, as advertising manager; Fred Iggsberg, as general factory manager.

Young Radiator Company, Racine, Wis., reports operations during the last two months on a high basis with plant operations in most departments twelve hours a day, tool shop day and night, and with the highest number of employees on the payroll at any time in the history of the company.

Westinghouse Lamp Company, New York City, announced through its vice-president, A. E. Allen, a reduction in the list prices of four types of thirty-two candle power automobile headlight lamps, effective Sept. 1. The reduction in the list prices averages 18.6 per cent and effects 8 per cent of the automobile headlight demand.

Synthane Corporation, Oaks, Pa., manufacturers of laminated bakelite products, has appointed J. R. Johnson Philadelphia district sales representative. Other representatives are J. V. Rittenhouse, Chicago; H. G. Blauvelt, New York City; C. E. White & Company, Cleveland.

Benolite Varnish Company, Pittsburgh, Pa., is the new name for Benolite Company, Inc., which now maintains executive offices at 2310 Koppers Building, Pittsburgh. O. V. Stewart has joined the company as consulting engineer and manager of sales. The firm manufactures a line of insulating varnish and compounds of protective.

Wagner Electric Corporation, St. Louis, has announced the transfer of F. C. Hosimer from the home office to the Chicago branch office, where he will join the sales force. Ralph R. Rughimer has been appointed a member of the Atlanta, Ga., branch sales office.

Misener Manufacturing Company, Inc,. is the new name for the Misener & Irving Manufacturing Company, Inc., Syracuse, N. Y.

Ohio Brass Company, Mansfield, Ohio, has opened a new office at 505 Insurance Building, Dallas, Tex. This office will be the headquarters of T. B. Jones, district sales manager for the company in the Dallas territory.

Titan Electric Company, Butler, Ind., manufacturer of electrical equipment, has announced plans for the removal of this plant to Adrian, Mich., where more extensive facilities will be employed for carrying out a photograph production program.

Dallas Brass & Copper Company has completed plans for three new building units to cost approximately $500,000, according to an announcement by C. D. Dallas, president. These additions will be made to the present rolling mills located on a 25-acre plot at 66th Street and Green Ave., Chicago.

American Rolling Mills Company has appointed W. J. Beck, for nineteen years director of the company's research department, as assistant to Charles R. Hook, general manager. Mr. Beck will have direct charge of the development in electrical steel sheets for magnetic purposes. He has been connected with the American Rolling Mills Company since 1903.

Colin B. Kennedy Corporation, South Bend, Ind., has named as chief engineer Rufus H. Caldwell. He joined the Sleeper Radio Corporation in 1924 as chief engineer and was intermittently associated with the designing of radio receiving sets. He was next identified with the DeForest Phonofilm Company, assisting Dr. Lee DeForest. Mr. Caldwell replaces Dr. Charles C. Lauritson, who has resumed his duties at the California Institute of Techonology, where he is professor of X-ray and electrical research.

Lincoln Electric Company, Cleveland, has placed contracts for the erection of a large addition to its present plant. This addition will add approximately one-half acre more floor space to the existing plant, and is expected to provide increased manufacturing facilities for a steady increasing volume of business.

Rome Wire Company, division of General Cable Corporation, announces that Fred N. Wardwell, formerly assistant engineer of the New York Central Lines, has joined the Rome organization as railroad sales engineer. He will be located at the executive offices at Rome, N. Y. During the past eleven years Mr. Wardwell has been closely identified with the electrification and equipment projects of the New York Central Lines, having had direct supervision of the Material Inspection Bureau of the Electrical Division.

Universal Metal Box & Products Company, Irvington, N. J., has announced the resignation of Walter J. Coleman, president of the company. His stock holdings have been taken over by Edwin C. Butler, who has been elected president. I. T. Friedman remains as secretary; J. H. Bachellor, formerly with the Public Service Electric & Gas Company, has been named vice-president and treasurer.

Steel & Tubes, Inc., Cleveland, has opened at Ferndale, Mich., a suburb of Detroit, a new welded steel tubing plant costing over $1,000,000 fully equipped. This unit will take the place of a former plant at Toledo, Ohio, but will be much larger in order to take care of increased business. The building is 537 ft. long by 211 ft. wide, containing 113,000 sq. ft. of manufacturing floor space. When in complete operation it

Coming Conventions

American Institute of Electrical Engineers.—Annual winter meeting at New York City, Jan. 27-31, 1930.

American Society of Mechanical Engineers.—Third national meeting of the Iron and Steel Division during the Steel Treaters' Convention, Cleveland, Ohio, Sept. 11-13. Third national fuels meeting at the Bellevue-Stratford Hotel, Philadelphia, Pa. Oct. 7-10. Annual meeting at New York City, Dec. 2-6.

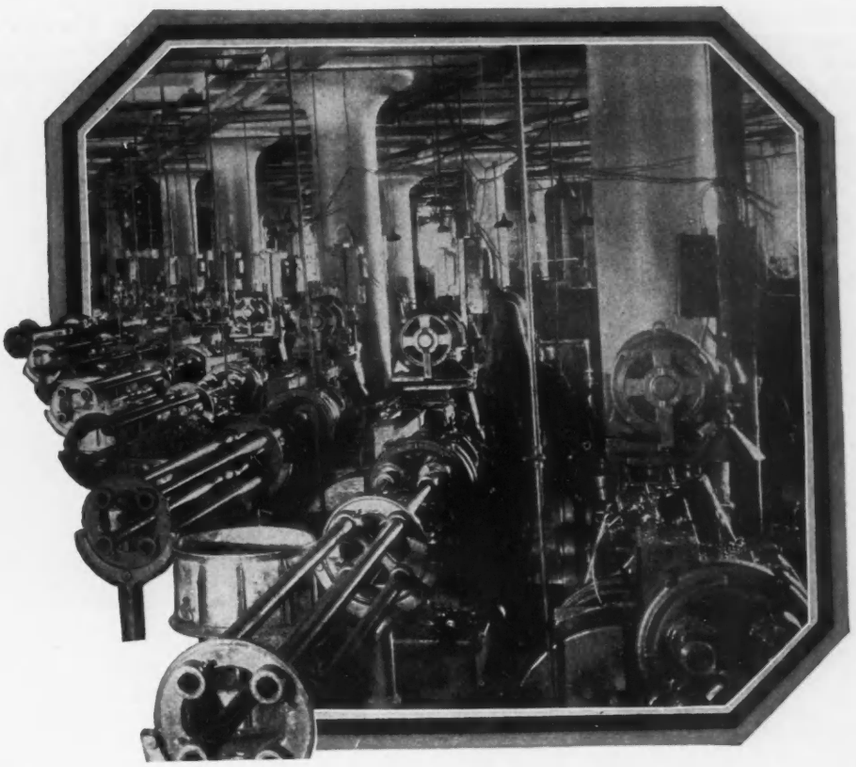
Chattanooga Power and Mechanical Exposition, in conjunction with 47th Convention of the National Association of Power Engineers, Chattanooga, Tenn., Sept. 9-13, inc. Frank N. Chapman, care of A. Leschen & Sons Rope Co., 5909 Kennerly Ave., St. Louis, Mo., secretary of the National Exhibitors' Association.

Illuminating Engineering Society.—Meeting at Philadelphia, Sept. 24-27.

National Association of Power Engineers.—47th Annual Convention, Chattanooga, Tenn., Sept. 9-13, inc. The Power and Mechanical Exhibition will be conducted in conjunction with the convention. Ivon F. Pieters, president, Plibrico Jointless Firebrick Company, 1800 Kingsbury St., Chicago, Ill. S. M. Chapman, secretary, 5909 Kennerly Ave., St. Louis, Mo.

National Electrical Manufacturers Association.—Annual fall meeting at the Wardman Park Hotel, Washington, D. C., Oct. 7-12.

National Metal Congress. — Cleveland, Sept. 9-13. Simultaneous meeting will be held of the American Welding Society, American Society of Mechanical Engineers (Iron & Steel Division), American Society for Steel Treating.



EFFICIENCY, SAFETY, VISIBILITY ECONOMY

THE purchaser of electric motors today is indeed prudent who utilizes the amazing advantages of motors equipped with New Departure Ball Bearings. So immune are these bearings from wear that there will be no perceptible armature drop after years of service. Lubrication becomes an annual operation instead of a daily or weekly necessity, maintenance expenditures are substantially reduced . . . these are economies that count, for they pay dividends as long as the motor functions. A dozen benefits of equal importance likewise affect the contents of your pocketbook.

The picture shown is a section of an automatic production line, motorized by Westinghouse — de-frictionized by New Departures. There are no belts to act as sight and light barriers, and to "shriek out" power losses. Employes are safer, more contented and more productive.

Write today for bearing literature pertaining to electric motors.

The New Departure Mfg. Company, Bristol, Connecticut; Detroit, Chicago and San Francisco.

NEW DEPARTURE

BALL BEARINGS

1274

NOTHING ROLLS LIKE A BALL

will employ about 300 men, with an established output of 3,000,000 ft. of steel tubing a month.

A. F. Dormeyer Manufacturing Company is the new name for the MacLeod Manufacturing Company, 2640 Greenview Avenue, Chicago. Sales of the Dormeyer food mixer for the first six months of 1929 ran over 500 per cent above the sales for the same period a year ago.

Diamond Electrical Manufacturing Company, Los Angeles, Cal., has completed negotiations with Union Electrical Manufacturing Company, Milwaukee, for the distribution of Diamond E products east of the Mississippi. The Union Company maintains offices and stock in all of the principal Eastern cities. Additional distributors recently appointed by Diamond E are: Mora Electric Co., 7 Calle Soda, Manila, P. I., distributors for the Philippines; Robinson Sales Co., 617 Fourth Avenue, Seattle; Joseph Paulson, 218 Commonwealth Bldg., Portland, Ore.; O. H. Davidson Equipment Co., 130 W. Fourteenth Avenue, Denver; Farr Electric Service, 228 South West Temple Street, Salt Lake City.

Delta-Star Electric Company announces that Joseph C. Rah, formerly of the G & W Electric Specialty Company, is now with the Delta-Star organization in a consulting capacity.

Beardslee Chandelier Manufacturing Company, Chicago, has elected as vice-president in charge of sales of the Williamson line, Richard D. Williamson. Beardslee Chandelier and R. Williamson & Company recently merged interests. The complete line of both companies is now manufactured at the Beardslee factory at 216 S. Jefferson St., Chicago.

General Electric Company, through its president, Gerard Swope, has announced reductions in the prices of popular types of 32 candlepower Mazda lamps for automobiles, effective Sept. 1. The reductions range from ten to twenty-five per cent on individual types. This announcement is in line with the General Electric Company's policy of passing on to the consumer savings made possible through manufacturing economies in its lamp factories, Mr. Swope explained.

Manufacturers Literature

ELECTRICAL MANUFACTURING *presents a digest of recently issued catalogs, bulletins and other advertising material. Manufacturers are invited to send literature for review in this column.*

Commonwealth Brass Corporation, Detroit, has issued a new catalog of pipe and tube fittings for the refrigeration industry. This printing is a complete encyclopedia of fittings for refrigerator manufacturers. This company's line of "Seepage-Proof" fittings is designed for use in refrigeration systems using either methyl chloride, sulphur-dioxide, iso-butane, ethyl-chloride, methylene-chloride, carbon-dioxide or similar refrigerants. All fittings listed in this catalog are produced from forgings or extruded brass rod subjected to enormous pressure, assuring non-porous fittings of close grained metal of homogeneous composition and great strength. The threads in all fittings are sharp and uniform. Seats are smooth. Every fitting is closely inspected.

Polymet Manufacturing Corporation, New York City. Catalog No. 2930, entitled "Polymet Radio Essentials," describing the company's line of filtration, by-pass, micre, molded and equalizing condensers and tubular strips, metallized, volume controls and heaters in the way of resistances.

Despatch Oven Company, Minneapolis. "Electric Oil and Salt Baths," a bulletin featuring a new line of electric oil and salt baths manufactured by this company.

R. G. Haskins Company, Chicago. Catalog No. 41 describing and illustrating flexible shaft equipment and tools and accessories used in manufacturing and industrial plants.

Linick, Green & Reed, Inc., 10 South Wabash Ave., Chicago. A new booklet describing various styles of flexible shaft machines and their uses. Over 600 tools, many of the latest developed designs are illustrated. Machines for undercutting commutators, removing insulation, grinding, cutting, engraving, polishing, burnishing, removing or modifying photograph sound on sound-motion picture, erasing sound on track imperfections on sound-picture disks and marketing switchboards, slate and bakelite.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Booklet SP 1854, showing the part Westinghouse is playing in the advance of aviation from the standpoint of lighting equipment for the night illumination of airports. Included in this publication are the lighting requirements of the Department of Commerce, mentioning the candle power for beacon, wattage for lights, obstruction light requirements and the location of floodlights in ceiling projectors. Leaflet 3746-B, describing the company's new line of fabricated synchronous motor generator sets.

World's Smallest Voice Broadcasts

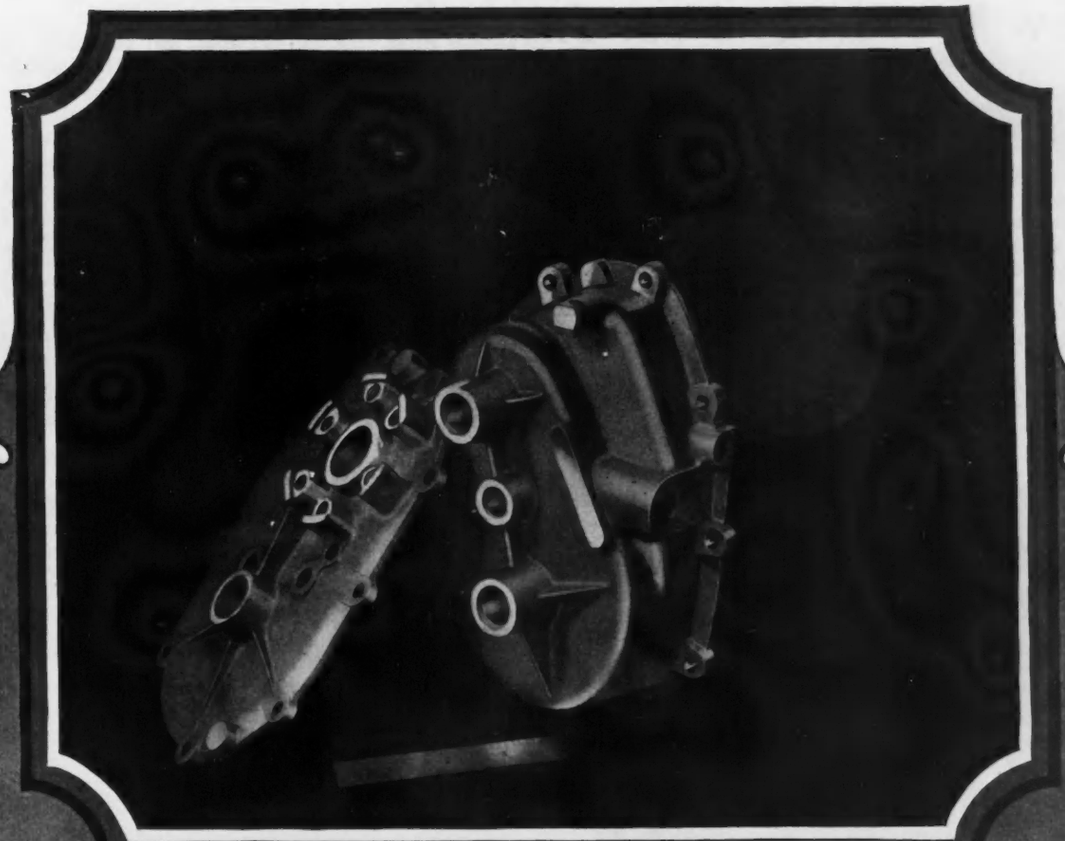
SOUNDS like the patter of hail against a window-pane came from the ether recently when atoms, exploding from a piece of uranium, were broadcast over a coast-to-coast hookup. L. A. Hawkins, General Electric Co., is pictured above holding a small piece of uranium before an amplifying apparatus, known as the "Geiger Counter"

Information Wanted

We have been asked for the names and addresses of manufacturers of the articles listed herewith.

Replies from our readers to any of these inquiries will be greatly appreciated by the Information Bureau of ELECTRICAL MANUFACTURING, 461 Eighth Avenue, New York City.

"Parker" Canopy Insulating Block.
"Burrows" Therapeutic Lamp.
"L. R. Co." Receptacles.
"Williams" Commutator Dressing.
"Splendida" Electric Iron.
"Flint" Waffle Iron.
"Pioneer" House Pump.
"Blaisdell" Electric Cigar Lighter.
"Defiance" Cigarette Lighter.
"Hillcrest" Line of Lighting Fixtures.
"Vesodore" Cigar Lighter.
"Thermodyne' Therapeutic Lamp.
"Medsco Beauty" Iron.
"Safeway Plugs."
Electromatic Traffic Dispatch Co.
"Aspinall" Soldering Fluid.
Electric-driven lampshade lacing machines.
Steel collapsible barrels used for post hole digging.



Integrity

Beyond the quality value of Newton Die Castings is the pledged responsibility of this company's service—intangible in the castings themselves but a very real factor in the measure of their satisfaction!

There is deep significance in the fact that the widening preference for Newton Die Castings is unmistakably the effect rather than the cause of a higher type of service.

The NEWTON DIE CASTING Corp'n.

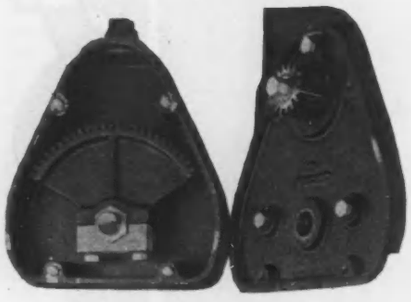
146 Munson St. NEWTON NEW HAVEN New Haven, Conn.

N.D.C.19

New Goods for Your Inspection

Drum Switch Operating Mechanism

General Electric Co., Schenectady, N. Y., announces an operating mechanism for use with drum switches mounted in crane cabs and similar places. This mechanism, superseding the rack-and-pinion under-lever type, eliminates the trouble experienced in keeping a perfect lineup between the shaft of the operating mechanism and the drum switch shaft, and makes it possible to enclose the mechanism to keep dirt from the gear lubricant.



The mechanism consists of a pinion on an extended drum switch shaft, meshing with a segment gear, all housed in a dust-tight cast case provided with plugged access hole for gear slushing and with a short lever arm projecting below the case. The lever arm can be connected with the reach rod in the same way as with the old rack-and-pinion type.

The mechanism will be assembled with the drum switch by the manufacturer.

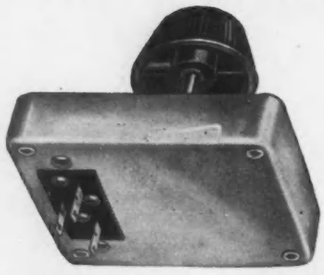
Reynolds Type "C" Motor

Reynolds Electric Co., 2650 W. Congress St., Chicago, is marketing a type "C" electric motor in sizes ranging from 1/20 to ¼ horsepower. The general design is rugged and substantial and the frame is made of cast iron. The stator is made up of punchings pressed and riveted together, while the rotor is of the squirrel-cage type with copper end rings

welded to the copper bars. All windings are made of cotton covered enameled wire inserted in the insulated slots and held in place by wedges. Ample insulation is provided against abuse and moisture and lubrication is had by means of oil wells filled with wool yarn. Bearings are oversize, of cast bronze, and all of the motors, are of the partially enclosed type.

High Resistance Volume Control

Electrad, Inc., 173-175 Varick S., New York City, is marketing a five-watt high resistance volume control for radio apparatus. The device can be made in any desired range with either uniform resistance tapered to specifications. The entire mechanism is enclosed in a metal case and fused molded insulation. Contacts are of

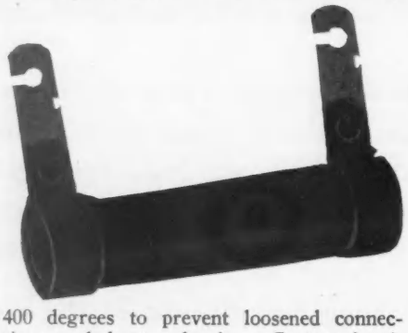


silver of a type known as floating. The resistance element is composed of graphite paint fused to an enameled steel plate at high temperatures. The device is 2 3/16 in. square by ⅝ in. deep.

Layer-Wound High Resistance

Electrad, Inc., 173-175 Varick St., New York City, is producing a layer-wound high resistance for use as plate resistors, multipliers, for voltmeters and general laboratory work.

It is made up of Nichrome resistance wire wound around a refractory tube and the entire unit is covered with a coating of moisture-proof enamel, baked on at only



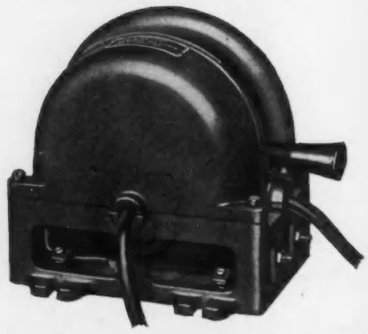
400 degrees to prevent loosened connections and fractured wire. Contact bands and soldering lugs are of monel metal and the lugs are solder-dipped for easy soldering.

The overall length of the unit is 2 in. with a maximum outside diameter of ⅝ in. It is made with resistance ratings from 10,000 to 250,000 ohms.

Field Discharge Switch

Taft-Pierce Mfg. Co., Woonsocket, R. I., is marketing a field discharge switch for use with magnetic chucks. These chucks were designed to dissipate the high voltage surge induced in the windings of an unprotected circuit when the operator of a magnetic chuck throws the switch, thus preventing the puncturing of coil insulation through this cause. They are intended primarily for use on chucks of high rating.

When an operator opens the switch of a large magnetic chuck the voltage surge in the coils will build up instantaneously to several times the normal operating voltage. This surge is of but a moment's dur-

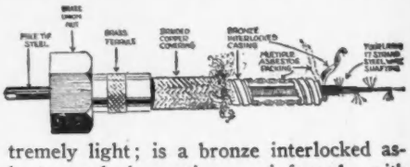


ation, but when repeated continually through use over a matter of months, it is very apt to cause trouble by puncturing the coil insulation. Surge is definitely limited to a harmless intensity and dissipated through resistance coils by using the field discharge switch.

Tachometer Drive Shaft

Consolidated Instrument Company of America, 305 E. 47th St., New York City is manufacturing an improved type of drive shaft for tachometers.

The inner cable of the shaft is constructed of 17 strands of high carbon high tensile strength music wire, in 4 layers, under special process. The casing is ex-



tremely light; is a bronze interlocked asbestos-packed section, reinforced with copper braided armoring. It has a natural bronze finish, with no japanning or lacquer to scale off. It is also flexible, and will permit of sharp bends, making installation easy.

"Beetle" Molding Powder

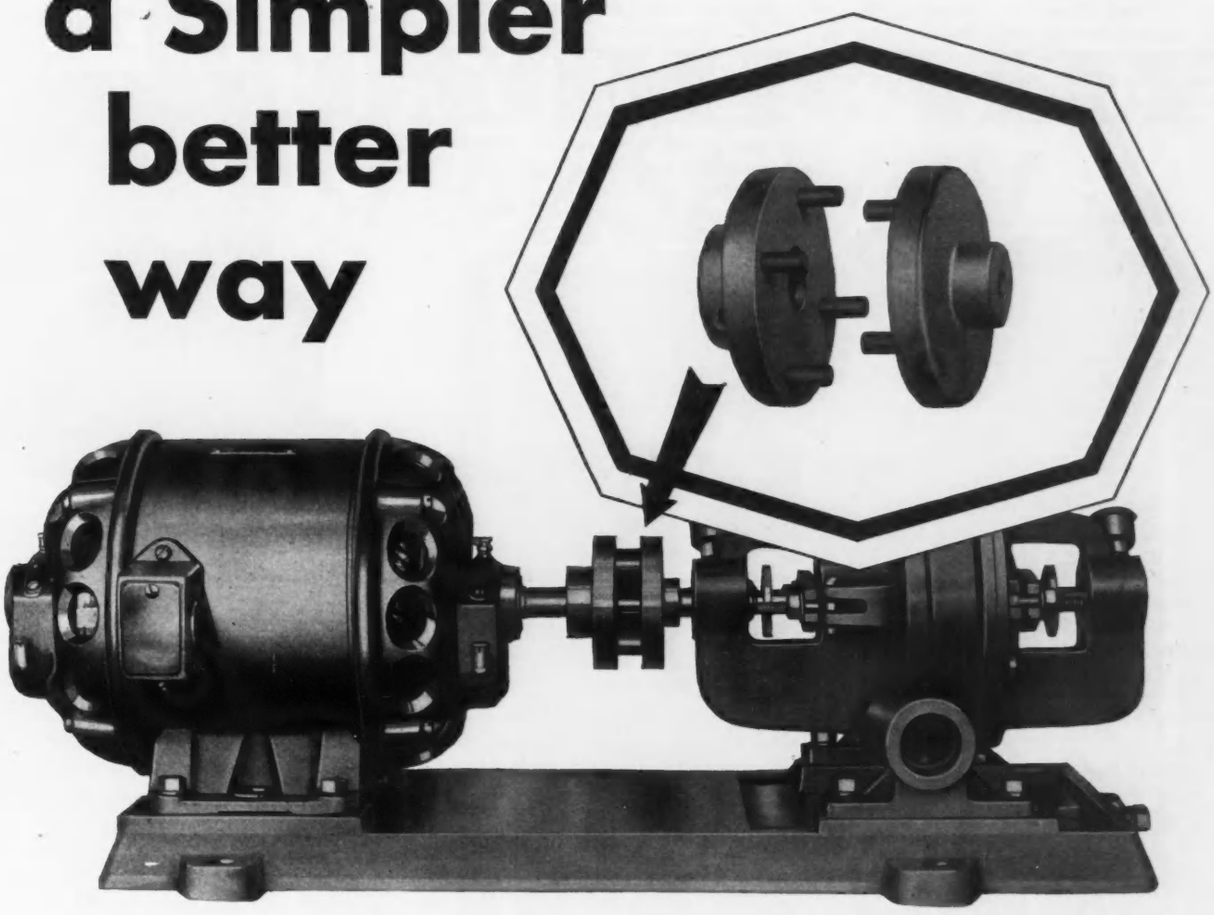
Synthetic Plastics Co., 535 Fifth Ave., New York City, announce a thermo-reactive molding powder available in light, translucent colors. It contains no phenol and its specific gravity is 1.49, with a tensile strength of from 5,000 to 6,000 pounds to the inch. It is dielectric, flexible in thin sections and has a high lustre.

A Battery Compound

Goodyear Chemical Co., Inc., of 20 West 22d Street, New York City, manufacturers of commercial chemicals, is marketing a battery compound. The product, Electex, is intended to increase the efficiency of all storage batteries using sulphuric acid electrolyte.

Electex is a non-acid compound, composed of chemical products, designed to increase the performance of a storage battery. This is accomplished principally through prevention of excessive sulphation, and considerably reducing the temperature thus preventing undue expansion. This in turn eliminates buckling of plates.

a Simpler better way



. . . . to make a coupling!

This non-technical, illustrated booklet may suggest an easier, better way to make parts of your product. Send for your copy today.

THE Westco-Chippewa Pump Co. found it, when they turned to die casting as a means of improving the design and performance of the couplings used on small pumps and water systems.

These couplings now consist of two simple, zinc alloy die castings, circular flanges about 3/8" thick. In each flange are four steel driving pins, accurately cast into place when the casting is made. A shoulder on each pin anchors it permanently into position as the zinc alloy solidifies.

The only machining required is the reaming of the shaft hole. The die used is so designed that various sized shaft-holes can be cast, either with or without the key-way.

The lighter weight of die cast couplings has greatly reduced vibration and noise. Casting the pins into place as an integral part of the flange has eliminated several machine and assembling operations.

Perhaps die casting parts of your product would result in similar improvements. Why not let us help you find out?

MILWAUKEE DIE CASTING CO., *289 Fourth Street, Milwaukee, Wis.*

MILWAUKEE

DIE CASTINGS AND BEARINGS

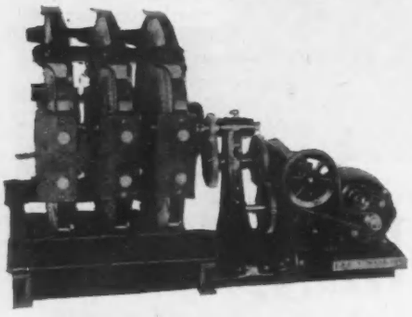
Model C "Paint-O-Mister"

The Automister Co., Rahway, N. J., is manufacturing an electric gun-cup spraying machine, intended for spraying paint, lacquer, varnish and disinfectants in homes and industrial plants.

The device includes a standard Automister compressing unit with a universal type motor, operating on 25 to 60 cycles, 110-125 volts, A. C. or D. C. The spray gun has two nozzles and a one-quart container with 12½ feet of air hose.

Reco Dimmer Flasher

Reynolds Electric Co., 2618 West Congress St., Chicago, is manufacturing a dimmer flasher device that is designed for securing unusual dimming and color blending effects in window displays, the floodlighting of buildings, illuminated outdoor electric signs, interior display, the stage of the theater natural phenomena, gardens, mountains, amusement centers, etc.



The dimmer-flasher is simple in design and construction. It affords automatic control, with "holding" effects if desired, and is capable of producing beautiful and subtle mobile color effects.

It gradually dims lights in fifty steps from dull to bright and from bright back to dark. There is no limit to the number of colors that may be softly, almost imperceptibly dimmed, and dissolved into one another.

One feature is that of simplicity of construction. The entire mechanism being built so as to eliminate involved and complicated parts.

"Konel" Metal

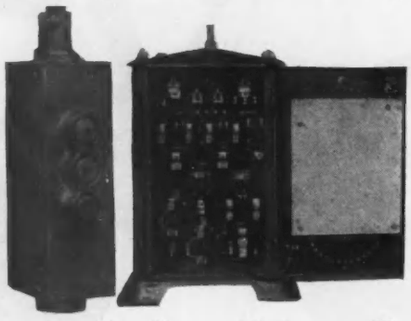
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., have developed in their research laboratories a metal known as "Konel," which is credited with being much stronger than many other metals at high temperatures and which can be used in the moving parts of combustion engines and other extremely hot places. It was originally developed as a substitute for platinum in the manufacture of filaments for radio tubes. The new metal is more difficult to forge than steel and is very tough at high temperatures.

Pendant Control for Planers

General Electric Co., Schenectady, N. Y., announces a magnetic controller and push-button station, designated as CR-4602-L-5 and CR-2940-BS-14-CR, respectively.

The panel is of standard design with an added section on which are mounted the relaying contactors governed by the push-button station. This extra section may be added to standard pedestal type magnetic controllers now in service.

The pendant push-button station has four buttons: "Automatic," "Out," "Return" and "Stop." The "Start" button is located at the controller itself but, after pressing the "Stop" button at the pendant station, operation may be resumed by



pressing the "Automatic" button. The "Stop" button is at the bottom of the station, readily accessible from all angles. The push-button station is very light, is approximately 2 in. wide, 6 in. high and 2¼ in. deep.

In operation, pressing the "Start" button in the door of the main panel closes the circuit breaker contactor. The "Automatic" button is then pressed, but operation does not start until either the "Out" or "Return" button is pressed, depending on the desired running direction. If the wrong button is pressed for the position of the planer at that time, nothing will happen.

One advantage of the new control is that, when machining large castings, it is not necessary for the operator to climb out of the casting every time it is desired to operate. He has full control from the pendant push-button station.

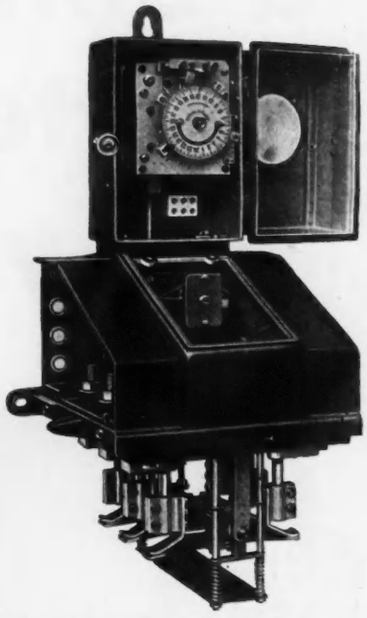
Sauter Electric Time Switch

R. W. Cramer & Company, Inc., 136 Liberty St., New York City, is marketing ZMO type single throw self-winding time switch. The main switch is motor operated double break, quick acting, laminated brush contacts with substantial arcing tips. The entire main switch operates in a bath of circuit-breaker-oil, to maintain long contact-life under these heavy loads. These contacts are guaranteed for constant load at rated capacity (per pole) plus 25 per cent. overload.

The electric motor is the same as used in all Sauter time switches. It is of the series type, 115/230-volt, operating on any standard frequency or on direct current without adjustment.

The time movement is a self-winding clock with oversize precision-cut gears. When desired this clock can be furnished with the Sunday-cut-out; automatically causing the time switch to suspend its functions every seventh day.

The toggle switch control contact is operated by 24-hour dial; the contact being used only to close the electrical winding



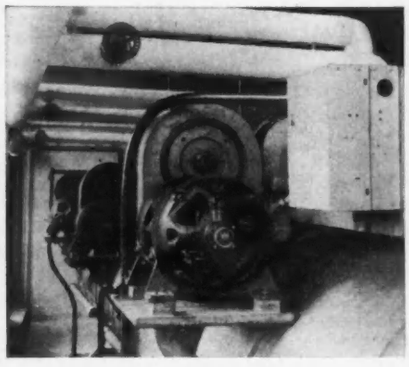
circuit, the opening of this 20-watt circuit being accomplished from position-control wiping-contacts on rotary main-switch shaft. A single 24-hour dial serves both for time and program setting.

Reversing Motors and Control

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has announced a type of reversing motor and control for use on washing machines and drying tumblers. The equipment consists of a type CS washing machine motor, a reversing switch and a linestarter.

The washer motor is designed to withstand frequent full voltage reversals and these are effected by connecting across the line. Low plugging torque permits the motor to stop and reverse gradually.

Mechanically, the motor is the standard



Westinghouse CS type of construction, including open end brackets, sealed sleeve bearings, high quality insulation and single shaft extension.

The control unit employed is the standard linestarter, which may be used with a ture of filaments for radio tubes. The

The reversing switch is driven by means of a chain from the washer or dryer. Operation of the mechanism is possible at all speeds, and contacts are of standard type.

ECONOMICALLY *die cast by Stewart* ▾ ▾

Note how the Stewart Process made this vacuum cleaner available to housewives with average pocketbooks

HERE is an example of Stewart die-casting in which a complete housing is produced in two halves, making an assembly that not only improves the quality of cleaner as a household utility, but also reduces its cost.

The Stewart process provides strong, light weight, interchangeable die-cast parts, accurate to the thousandth of an inch, and possessing exclusive detail refinements attained only by Stewart Engineers. Due to their accuracy of detail and perfection of finish, machining, handling and assembling expenditures are almost eliminated. Thus manufacturing operations are simplified and unit costs measurably reduced.

Manufacturers, who believe that their production details are too complicated, are invited to investigate the economic advantages of die-casting. A Stewart Engineer will be glad to call and discuss your requirements with you, or we will submit definite information upon receipt of blue prints or samples of your present production.

Stewart

THE STEWART DIE-CASTING CORPORATION
4500 Fullerton Avenue, Chicago, Illinois
Detroit ∴ Pittsburgh ∴ Dayton ∴ St. Louis
Newark ∴ Cleveland

Index of Raw Materials, Parts, Electrical Equipment

For all electrical products including electrically operated machines and appliances

Trade Names—Manufacturers' Names—Local Addresses

The names of all manufacturers are grouped alphabetically under the heading for the product they manufacture. Trade names also appear in alphabetical position under the subject identifying the product. Thus "Linolac" insulating varnish will be found in alphabetical position under the heading "Paint, Varnish, Lacquer."

Note: The Classified Index of **ELECTRICAL MANUFACTURING** is limited to those subjects of interest to the specific field which it covers, for obvious reasons. A complete Classified Index of all electrical commodities bought, sold, or used by Electrical Supply Jobbers, Contractors, Dealers, Central Stations and other electrical industry outlets appears regularly in each issue of ELECTRICAL RECORD as heretofore.

ALLOYS, LIGHT METAL
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.

ALUMINUM
(Also Aluminum Bronze Powder.)
Albron, Alcoa, Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh.

AMMETERS. See Instruments.

ARMATURE
Balancers. See Balancers, Armature.
Banding Machines. See Banding Machines, Armature
Bearings. See Bearings.
Buggies. See Lifts, Armature.
Coil Presses. See Presses, Armature Coil.
Coils. See Coils, Finished.
Core Punchings. See Discs, Armature.
Cranes. See Lifts, Armature.
Discs. See Discs, Armature.
Driers. See Ovens.
Growlers. See Testers, Coil.
Hoists. See Lifts, Armature.
Impregnators, Vacuum. See Ovens, Industrial.
Jacks. See Lifts, Armature.
Laminations. See Discs, Armature.
Lathes. See Lathes.
Lifts. See Lifts, Armature.
New. See Coils, Finished.
Notching Machines. See Notching Machines, Armature.
Pegs. See Pegs, Armature.
Pinion Pullers. See Pullers, Armature Shaft.
Repaired. See Repairing and Second-Hand.
Shaft Pullers. See Pullers, Armature Shaft.
Shaft Straighteners. See Straighteners, Armature Shaft.
Stands. See Stands, Armature.
Test Benches. See Test Benches, Armature.
Testers. See Testers, Coil; also Test Benches, Armature.
Torpedo Cord. See Twine, Armature Winding.
Trouble Shooters. See Testers, Coil; also Test Benches, Armature.
Trucks. See Lifts, Armature.
Wedges. See Pegs, Armature.
Winding Machines. See Winding Machines, Armature & Field Coil.
Winding Twine. See Twine, Armature.

ARMATURE & COIL SPRAY GUNS. See Spraying Outfits.

ARMORING MACHINES. See Wire Manufacturing Machines.

ARMS, FLEXIBLE. See Tubing Flexible Metallic.

ASBESTOS Shades. See Shades, Fabric.
Paper & Sheet. See Asbestos.
Slabs. See Asbestos Slabs.
Tape. See Tape, Asbestos.
Wire. See Wire, Insulated.
Yarn and Thread. See Yarn and Thread.

ASBESTOS
Sheet, Paper, Mill Board, Lumber.
Ambler Asbestos Shingle & Sheathing Co., Ambler, Pa.
Easco. See Eastern Asbestos Co.
Eastern Asbestos Co., Providence, R. I.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp., New York, N. Y.

ASBESTOS SLABS
Slabs & Barriers for Switchboard.
Asbestos-Ebony. See Johns-Manville, Inc.
Ambler Asbestos Shingle & Sheathing Co., Ambler, Pa.
Asceleco, Inc., Wayne, Mich.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp., New York, N. Y.
Transite. See Johns-Manville, Inc.
Zellite. See Asceleco, Inc.

BAGS, Vacuum Cleaner
Merrimack Mfg. Co., Boston, Mass.

BALANCERS, Armature
(Dynamic Balancing Machines—Balancing Ways).
Anderson Bros. Mfg. Co., Rockford, Ill. (Ways).
Armature Coil Equip. Co., 2415 Forestdale Ave., Cleveland, O. (Machine).
Bowsher Co., N. P., South Bend, Ind.
Cisco Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. (Machines).
Sundstrand Machine Tool Co., Rockford, Ill.
Twentieth Century. See Sundstrand Machine Tool Co.
Vibration Specialty Co., 1534 Winter, Philadelphia, Pa. (Machines).

BALL BEARINGS. See Bearings, Ball and Roller.

BANDING MACHINES, Armature
Columbia Machine Wks. & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.

BARRIERS, Switchboard. See Slate; also Soapstone; also Asbestos.

BARS, BUS. See Brass, Bronze & Copper; also Aluminum.

BARS, Commutator
Anaconda. See American Brass Co.
American Brass Co., Waterbury, Conn.
Buckeye Tempered Copper & Brass Co., Mansfield, O.
Cameron Electric Mfg. Co., Ansonia, Conn.
Commutator Co., 121 N. Front, Minneapolis, Minn.
Electric Materials Co., North East, Pa.
Eureka Metal Products Corp., North East, Pa.
Homer Commutator Co., 4748 Hough Ave., N. E., Cleveland.
Rome Brass & Copper Co., Rome, N. Y.

BASES, Radio Tube. See Radio Molded Parts.

BASES, Reading Lamp
Metal, Pottery, Wood & Glass.
American Ring Co., Waterbury, Conn.
Aladdin Mfg. Co., Muncie, Ind.
Armor Bronze Co., Garwood, N. J.
Camden Art Tile & Pottery Co., Camden, Ark.
Colonial. See Old Colony Iron Wks.
Estes & Sons, E. B., 5844 Grand Central Terminal, New
Fulper Pottery Co., Flemington, N. J.
Globe Metal Spinning Co., 178 Centre, New York, N. Y.
Hemill Products, Inc., 103 Mott, New York, N. Y.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Marbleart. See Insulation Mfg. Co.
Natural. See Insulation Mfg. Co.
Old Colony Iron Wks., Bridgeport, Conn.
Rocale Mfg. Co., 200 Hudson, New York, N. Y.
Sneath Glass Co., Hartford City, Ind.
Van Briggle Tile & Pottery Co., Colorado Springs, Colo.
Weller, S. A., Zanesville, O. (Pottery.)
Yokel Corp., 219 Homestead Ave., Hartford, Conn.
Zane Pottery Co., South Zanesville, O.

BATTERY CHEMICALS. See Chemicals, Battery.

BATTERY CUT OUTS. See Switches, Battery.

BATTERY GAGES. See Instruments, Pocket.

BATTERY JARS. See Jars, Battery, Glass; also Rubber; also Molded Insulation.

BATTERY OXIDES. See Chemicals, Battery.

BATTERY SALTS. See Chemicals, Battery.

BEAD CHAIN. See Chain, Socket.

BEADS, Chandelier. See Crystals, Chandelier.

BEADS, Insulating
American Lava Corp., 1425 William, Chattanooga, Tenn.
Durco. See Struthers Dunn, Inc.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.

BEARINGS
Ball & Roller. See Bearings, Ball & Roller.
Graphite. See Bearings, Oil-less.
Oil-less. See Bearings, Oil-less.
Sleeve. See Bearings & Bushings.

BEARINGS, Ball and Roller
Ahlberg Bearing Co., 312 E. 29th, Chicago, Ill.
Auburn Ball Bearings Co., 73 Clarissa, Rochester, N. Y.
Bantam Ball Bearing Co., South Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Commercial. See Schatz Mfg. Co.
C J B. See Ahlberg Bearing Co.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearing Co., Poughkeepsie, N. Y.
Gurney. See Marlin-Rockwell Corp.
Hyatt Roller Bearing Co., Newark, N. J.
Hoffman. See Norma-Hoffman Bearings Corp.
McGill Metal Co., Valparaiso, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
New Departure Mfg. Co., Bristol, Conn.
Nice Ball Bearing Co. (Nicetown), Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Whitehead Rd., Trenton.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Schubert. See McGill Metal Co.
Standard Steel & Bearings, Inc., Plainville, Conn.
Strom Bearings Co., 4587 Palmer, Chicago, Ill.
S. K. F. Industries, 40 E. 34th, New York, N. Y.
Timken Roller Bearing Co., Canton, O.
Torrington Co., Torrington, Conn.

BEARINGS, Oil-Less
Argute Oilless Bearings Co., 149 Berkeley, Philadelphia, Pa.
B. M. C. See Burlington Metal Corp.
Bogert & Hopper, Inc., 235 Variek, New York, N. Y.
Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Burlington Metal Corp., Burlington, Wis.
Cleveland Graphite Bronze Co., 880 E. 72nd, Cleveland, O.
Electric Railway Equipment Co., 30 Church, New York, N. Y.
Elreco. See Electric Railway Equipment Co.
Graphalloy. See Graphite Metallizing Co.
Graphite Metallizing Co., Yonkers, N. Y.
Lubrite. See Merriam Bros., Yonkers, N. Y.
Merriam Bros., 1555 Amory, Boston, Mass.
Metal Saw & Machine Co., Springfield, Mass.
Moraine Products Co., First & Foundry Sts., Dayton, O.
Neveroil Bearing Co., Wakefield, Mass.
Nolu Oilless Bearing Co., 6 E. Johnson, Philadelphia, Pa.
O. & S. Bearing Co., 315 S. Artillery, Detroit, Mich.
Reliance. See Metal Saw & Machine Co.
Selb Lignum-Vitae Woodturning Co., 98 Boyd Ave., Jersey City, N. J.
United States Graphite Bearing Co., Saginaw, Mich.

BEARINGS AND BUSHINGS
(For Armature Shafts.)
Adjustable Bearing Co., 101 Transportation Bldg., Indianapolis, Ind.
Ajax Metal Co., Philadelphia, Pa.
American Bronze Corp., Berwyn, Pa.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bunting Brass & Bronze Co., Toledo, Ohio.
Damascus Bronze Co., Pittsburgh, Pa.
Durex. See Moraine Products Co.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit,
Flood City Mfg. Co., Johnstown, Pa.
Johnson Bronze Co., New Castle, Pa.
Lumen Bearing Co., Buffalo, N. Y.
Moraine Products Co., First & Foundry Sts., Dayton, O.
National Bearing Metal Corp. (More-Jones Brass & Metal Div.), 4030 Manchester Ave., St. Louis, Mo.
United States Graphite Co., Saginaw, Mich.

BELTING, Chain Transmission. See Chain, Power Transmission.

BELTS, Rubber
Molded Cord Rubber Belts for Electrical Appliances.
Fay Rubber Products Co., Elyria, O.
Gilmer Co., L. H., Cottman & Keystone Sts. (Tacony), Philadelphia, Pa.

BENDERS, Coil Loop
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.

BENDING. See Punching & Bending.

BINDING POSTS. See Posts, Binding.

BLADES, Fan
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y.
Torrington Mfg. Co., Torrington, Conn.

BLUESTONE. See Chemicals, Battery.

BOARD, Fuller. See Cloth and Paper.

BOARD, Press. See Cloth and Paper.

BOMBARDING MACHINES. See Machines, Lamp Making.

BOWL HOLDERS. See Fixture Fittings.

BOX & CABINET BUSHINGS. See Bushings, Box & Cabinet.

BOX BOARD
Container Corp. of America, 111 W. Washington, Chicago.
Mid-West Box Co., 111 W. Washington, Chicago.

BOXES, Fibre
Container Corp. of America, 111 W. Washington, Chicago.
Corrfibre. See Container Corp. of America.
Mid-West Box Co., 111 W. Washington, Chicago.

BOXES, Sheet Steel. See Cabinets, Sheet Steel.

BOXES, Wood. See Cabinets & Boxes, Wood.

BOXES AND WRAPPERS
Agar Mfg. Corp., Whippany, N. J.
Brown & Bailey Co., 417 N. Eighth, Philadelphia, Pa.
Bulldog. See Pittsburgh Corrugated Paper Box Co.
Campbell Paper Box Co., South Bend, Ind.
Consolidated Paper Co., Monroe, Mich.
Container Corp. of America, 111 W. Washington, Chicago.
Geir Co., Robert, 420 Lexington Ave., New York. (Boxes.)
Gator-Hide Kraft. See International Paper Co.
Hinde & Dauch Paper Co., 304 Decatur, Sandusky, Ohio.
Huntington Paper Box Co., Huntington, Ind.
International Paper Co., 100 E. 42nd, New York, N. Y.
Lake Lithographing Co., 2570 Superior Ave., Cleveland, O. (Display Cartons.)
Mid-West Box Co., 111 W. Washington, Dept. 36, Chicago.
National Folding Box Co., New Haven, Conn. (Cartons.)
Pequot Mfg. Corp., Glendale (L. I.), New York.
Pittsburgh Corrugated Paper Box Co., Pittsburgh, Pa.
River Raisin Paper Co., Monroe, Mich.
Rockford Fibre Container Co., Rockford, Ill.
Sefton Mfg. Co., 59 E. Madison, Chicago, Ill.
Shuttleworth Carton Co., 474 W. Broadway, New York.

BRACKETS, Instrument
For Suspending Meters to Station Switchboard.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

BRAIDING MACHINES. See Wire Manufacturing Machines.

BRASS TUBING. See Tubing, Brass and Copper.

BRASS, BRONZE AND COPPER
Sheet, Rod, Bar.
Anaconda. See American Brass Co.
American Brass Co., Waterbury, Conn.
American Nickeloid Co., Peru, Ind.
Baltimore Brass Co., 1212 Wicomico, Baltimore, Md.
Baltimore Copper Mills, (Div. of General Cable Corp.) Baltimore, Md.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Buffalo Bronze Die Cast Corp., 100 Arthur, Buffalo, N. Y.
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
Durbar. See Buffalo Bronze Die Cast Corp.
Electric Materials Co., North East, Pa.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit,
Higgins Brass & Mfg. Co., 12435 Dequindre, Detroit, Mich.
Michigan Copper & Brass Co., 5851 W. Jefferson Ave., Detroit, Mich.
Nickeloid. See American Nickeloid Co.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Taunton-New Bedford Copper Co., Taunton, Mass.
Titan Metal Mfg. Co., Bellefonte, Pa. (Rods and Forgings.)
Western Cartridge Co., East Alton, Ill.

BREAKERS, Circuit. See Circuit Breakers.

BRIDGES, Wheatstone. See Instruments, Laboratory Standard.

BRONZE. See Brass, Bronze and Copper; also Castings.

BRONZE, Phosphor. See Phosphor Bronze.

BRONZE POWDER, Aluminum. See Aluminum

BRUSH HOLDERS. See Brushes, Commutator.

BRUSHES, Carbon. See Brushes, Commutator.
Graphite. See Brushes, Commutator.
Metal Graphite. See Brushes, Commutator.

BRUSHES, COMMUTATOR
(Brushes, Brush Holders and Flexible Leads.)
Brush Holders ..... See B
Carbon, Graphite, Metal Graphite ..... See C
Flexible Leads and Pig Tails ..... See L
Sheet Metal ..... See S
Wire Gauze ..... See W
Automotive Mfg. Co., Kansas City, Mo. ..... B
B. B. B. See Becker Bros. Elec'l Corp.

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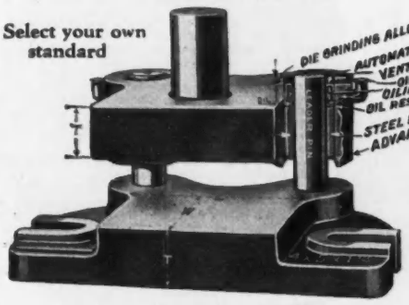

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Made of 25% Steel

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E. A. BAUMBACH MFG. CO.

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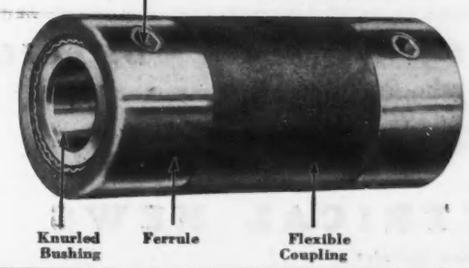
Oneida Flexible Coupling eliminates vibration and lost motion at points where it is most necessary to longer and safer service. Another point: this added protection will cut down sales resistance on your products.

DELBEE RUBBER CO.
Syracuse, N. Y.



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Illustrated here are only a few castings where substantial savings have been effected, due to partial, and in some cases, total elimination of costly machining operations. Castings are made from Aluminum, Zinc, Lead and Tin Base metals, alloyed to suit your particular requirements.

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DIE CASTING DIVISION

Barnhart Brothers & Spindler

Monroe and Throop Streets, Chicago

BRUSHES, Commutator—Continued
Baylis Co., Bloomfield, N. J. ..... B
Becker Bros. Elec. Corp., 23 N. Jefferson, Chicago, Ill. ..... C W S B L
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y. C
Bucill-Brual Carbon Co., Columbia Park, O. ..... C H
Calebaugh Self-Lubricating Carbon Co., 1563 Columbia Ave., Philadelphia, Pa. C
Carbon Engrg. Co., Slinger, Wis. ..... C I
Carbon Laboratories Co., 5005 Euclid Ave., Cleveland, O. C
Carbon & Graphite Corp., 227 West Broadway, New York, N. Y. C
Carmen. See Carbon Engineering Co.
Chapin Co., Chas. E., 127 Fulton St., New York, N. Y. ..... C W S L
Columbia Machine Wks. & M. L. Co., 363 Chestnut, Brooklyn, N. Y. ..... B
Cooley Mfg. Co., 98 Park Place, New York ..... W
Diamond C. See Chapin Co., Chas. E.
Dixon Crucible Co., Joseph, Jersey City C
Electra. See Automotive Mfg. Co.
Electric Accessories Co., 310 York Ave., Philadelphia, Pa. ..... B
Electro-Nite Carbon Co., 308 N. Fourth, Philadelphia, Pa. C
Eureka Metal Products Corp., North East, Pa. ..... W S H
Fleck Carbon Co., 306 Broome, New York C H L
General Electric Co., Schenectady, N. Y. ..... C H L
Graphalloy. See Graphite Metallizing Corp.
Graphite Metallizing Corp., 1040 Nepperhan Ave., Yonkers, N. Y. ..... C H
Henrite Products Co., 98 Park Place, New York, N. Y. C
Holland Trolley Supply Co., 1623 E. 43rd, Cleveland, Ohio ..... H
Jeandron, W. J., 845 Madison Ave., New York, N. Y. (Imported.) C
Kappstone Carbon Co., 4630 N. 11th, Philadelphia, Pa. C
Kohlenite Products Co., 92-34 152nd St., Jamaica, N. Y. C
Le Carbone. See Jeandron, W. J.
Le Valley Vitse Carbon Brush Co., 4851 Grand Central Terminal, New York, N. Y. C
Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich. C
Marquette Brush Co., 23-02 48th Ave., Long Island City, N. Y. C
National Carbon Co., Cleveland, O. C
New Process Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. ..... C L
No Spark. See Calebaugh Self-Lubricating.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, Ohio ..... C W L
Ohio Elec. Specialty Mfg. Co., Troy, O. ..... W
Perfection Supply Co., 98 Park Pl., New York, N. Y. ..... C W S H L
Pittsburgh Carbon Brush Co., 127 Fancourt, Pittsburgh, Pa. C
Pure Carbon Co., Wellsville, N. Y. ..... C W S L
Pyramid. See National Carbon Co.
Reactite. See Baylis Co.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y. ..... W L
Salem Electrical Supply Co., Salem, Mass. ..... W
Smarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. C
Spee-Dee Elec. Mfg. Co., 190 Lafayette, New York, N. Y. ..... C L
Speer Carbon Co., St. Mary's, Pa. C
Stackpole Carbon Co., St. Mary's, Pa. C
Sterling. See Carbon Laboratories Co.
Superior Carbon Products Co., North Rd., Poughkeepsie, N. Y. C
U. S. Graphite Co., Saginaw, Mich. C
Universal. See Graphite Metallizing Corp.
Weber Elec. Wks., Brooklyn Sta., Cleveland. C L
BRUSHES, PNEUMATIC SPRAYING. See Spraying Outfits.

BRUSHES FOR VACUUM CLEANERS
Omaha Brush Co., 320 N. 15th, Omaha, Neb. (Brushes rubristled.)
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.
BUGGIES, Armature. See Lifts, Armature.

BULBS, Glass
For Incandescent Lamps and Tubes.
Almo Mfg. Co., 38 Crawford, Newark, N. J.
Corning Glass Wks., Corning, N. Y.
Fayette Glass Bulb Co., 229 21st, Brooklyn, N. Y.
Libby Glass Co., Toledo, O.
BUNCHING MACHINES. See Wire Manufacturing Machines.
BUSHINGS, SHAFT. See Bearings and Bushings.

BUSHINGS, Box and Cabinet, Porcelain
Appleton Electric Co., 1704 Wellington Ave., Chicago, Ill.
Columbia Metal Box Co., 226 E. 144th St., New York, N. Y.
Harter. See Multi Elect. Mfg. Co.
Knox Porcelain Corp., Knoxville, Tenn.
Mineralloc Electric Co., 25 N. Peoria, Chicago, Ill.
Multi Electric Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Nelson Elec. Co., Plant City, Fla.
CABINET GRILL CLOTH. See Cloth, Untreated.

CABINETS, Fibre
Continental-Diamond Fibre Co., Bridgeport, Pa.
Vulcawood. See Continental-Diamond Fibre Co.
CABINETS, Refrigerator. See Refrigerator Cabinets.

CABINETS, Sheet Steel
Stamped and Turned-up Boxes and Cabinets.
Acme Blow Pipe & Sheet Metal Wks., New Orleans, La.
Adam Electric Co., Frank, St. Louis, Mo.
All-Steel-Equip. Co., Aurora, Ill.
American Metal Wks., 4363 Stanton Ave., Philadelphia, Pa.
American Steel Furniture Co., 27 W. 24th, New York, N. Y.
Aurora Steel Products Co., Aurora, Ill.
Benjamin Elec. Co., 1278 E. 16th, Los Angeles, Cal.
Berks Engineering Co., Reading, Pa.
Berthold Elec. Co., Gus, 551 W. Monroe, Chicago, Ill.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Chicago Hdwe. Foundry Co., North Chicago, Ill.
C. & P. Electric Wks., Springfield, Mass.
Cleveland Switchboard Co., 2925 E. 79th, Cleveland, O.
Coast Specialty Co., 73 E. Sixth, Portland, Ore.
Cole Metal Products Co., 33 Crescent, Long Island City.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Elec. Mfg. Co., 59 Columbus Sq., San Francisco, Cal.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Columbian Steel Tank Co., 1505 W. 12th, Kansas City, Mo
Commercial Mfg. & Supply Co., 1443 Delaware St., Denver.
Creiger Electrical Mfg. Co., 609 W. Lake, Chicago, Ill.
Diamond Elec'l Mfg. Co., 1330 E. 16th, Los Angeles, Cal.
Dowman-Dozier Mfg. Co., 1314 Murphy Ave., S. W., Atlanta, Ga.
Electric Apparatus Co., 764 N. Halsted, Chicago, Ill.
Electric Panelboard Co., 426 Exchange, Rochester, N. Y.
Federal Steel Products Co., 2 Ave. L, Newark, N. J. (Polarized Boxes.)
Fouch Elec. Mfg. Co., 105 N. Ninth, Portland, Ore.
Greater New York Metal Box Co., Inc., 143 W. 19th, New York.
Green Elec. Co., 31 N. Water, Rochester, N. Y.
Gurney Sheet Metal Wks., 718 E. 4th, Long Beach, Cal.
Hauer, J. B., Driggs Ave. and N. 11th, Brooklyn, N. Y.
Holzer Sheet Metal Wks., Inc., New Orleans, La.
Hough Mfg. Co., 2520 24th, Detroit, Mich.
Isert Co., J. H., 1234 Rowan, Louisville, Ky.
Karp Metal Products Co., 129 30th, Brooklyn, N. Y.
Kirtland Elec. Construction Co., 34 Herkimer, Albany, N. Y.
Large-Dail Mfg. Co., 406 Cherry St., Philadelphia.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lexington Elec. Products Co., 419 E. 24th, New York, N. Y.
Lorentzen, H. K., 155 Leonard, New York, N. Y.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Mansfield Elec. Hardware Co., Longview Ave., Mansfield, O.
Metropolitan Elec. Co., 2914 First Ave., S., Seattle, Wash.
Metropolitan Elec. Products Co., Blvd. at 14th, Long Island City, N. Y.
Milwaukee Vault & Cabinet Co., 521 Market, Milwaukee.
Mosher, S. L., 1951 Lawrence, Denver, Colo.
National Metal Box Co., Van Dyke & Ferris Sts., Brooklyn.
Newman Elec. & Mfg. Co., Eau Claire, Wis.
Par-Metal Products Corp., 3519 41st, Long Island City, N. Y.
Penn Electrical Co., 25 Water, Irwin, Pa.
Powerlite Switchboard Co., 4149 E. 79th, Cleveland, O.
Reelich. See Holzer Sheet Metal Works.
Robbins & Myers, Inc., Springfield, O.
Security. See Aurora Steel Products Co.
Standard Metal Box Corp., 950 Grand St., Brooklyn, N. Y.
Star Metal Box Co., 228 46th, Brooklyn, N. Y.
Superior Switchboard & Devices Co., 420 Schroyer Ave., Canton, O.
Tanner & Co., Wm. F., 511 S. Sharp, Baltimore, Md.
United Metal Box Co., 473 President, Brooklyn, N. Y.
United Sheet Metal Wks., 575 Howard, San Francisco.
Universal Metal Box & Products Co., 316 Colt, Irvington, N. J.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Wiegman & Co., E. M., 1908 Benton, St. Louis, Mo.
Wurdack Elec. Mfg. Co., 4444 Clayton Ave., St. Louis, Mo.

CABINETS AND BOXES, Wood
Accurate Molding Corp., 20 Morton, Brooklyn, N. Y.
Adler Mfg. Co., Louisville, Ky.
Adler Royal. See Adler Mfg. Co.
Ampere. See Donehue Lumber Co.
Art Woodworking Co., Inc., 1035 Seattle Blvd., Seattle, Wash.
Aston Cabinet Mfrs., 1223 W. Lake, Chicago, Ill.
Boehm Cabinet Co., J., 3216 W. 63rd St., Cleveland, O.
Carlon. See Art Woodworking Co.
Carolina Wood Products Co., Asheville, N. C.
Carrom Co., Ludington, Mich.
Caswell-Runyon Co., Huntington, Ind.
Cheney Piano Action Co., A. C., Castleton, N. Y.
Chickasaw Furniture Mfg. Co., Memphis, Tenn.
Clinton Corp., 342 Madison Ave., New York, N. Y.
Conrades Mfg. Co., 1942 N. Second, St. Louis, Mo.
Corlieth Cabinet Mfg. Co., St. Mary's, Pa.
Cory Cabinet Corp., Springfield, Mo.
Dekker Co., Geo., Henderson, Ky.
Ebert Furniture Co., 225 W. 34th, New York, N. Y.
Effein & Sons, Frederick, 44 Central Ave., Brooklyn, N. Y.
Empire-United Hat Block Co., 312 E. 22nd, New York.
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Excel Phonograph Mfg. Co., 400 W. Erie, Chicago, Ill.
Excello Products Corp., 4836 W. 16th, Cicero, Ill.
Federal Wood Products Corp., 206 Lexington Ave., New York, N. Y.
Findlay Mfg. Co., Metropolitan & Morgan Aves., Brooklyn.
Grand Rapids Furniture Co., Grand Rapids, Mich.
Harper Mfg. Co., Cassopolis, Mich.
Hickory Box Co., Hickory, N. C.
Hubbell, H. L., 59 Market Ave., N. W., Grand Rapids.
Interstate Woodworking Co., 46 Wooster, New York, N. Y.
Karpen. See Studner Bros.
King Mfg. Corp., 254 Rano, Buffalo, N. Y.
Klumpp Sons, John G., 13 Baxter, New York, N. Y.
Knoxville Table & Chair Co., Knoxville, Tenn.
National Cabinet Co., New Philadelphia, O.
New England Box Co., Greenfield, Mass.
Ohio Valley Cabinet Co., Wheeling (Warwood), W. Va.
Oneida Cabinet Corp., Oneida, N. Y.
Ottawa Furniture Co., Holland, Mich.
Pooley Co., 16th & Indiana Ave., Philadelphia, Pa.
Radio Allied Mfrs. Corp., 1340 S. Michigan Ave., Chicago.
Radio Cabinet Mfg. Corp., Furniture Mart, Chicago, Ill.
Radio Cabinet & Equipment Co., 1504 Vine, Philadelphia.
Radio Mfg. Co., Div. of Pillied Lumber Co., Swanton, O.
Radio Master Corp., Bay City, Mich.
Red Lion Cabinet Co., Red Lion, Pa.
S. E. Z. Cabinet Co., 54 North, Boston, Mass.
Schutz Bros., 152 Chambers, New York, N. Y.
Showers Bros. Co., Bloomington, Ind.
Signal Elec. Mfg. Co., Menominee, Mich.
Southern Toy Co., Hickory, N. C.
Specialty Display Case Co., Kendallville, Ind.
Starr Piano Co., Richmond, Ind.
Stettner Phonograph Corp., 669 Kent Ave., Brooklyn, N. Y.
Studner Bros., 67 W. 44th, New York, N. Y.
Superior Cabinet Corp., 206 Broadway, New York, N. Y.
Syracuse Screen & Grille Co., North Manchester, Ind.
Tessier Bros., 355 Bridge, Northampton, Mass. (Radio.)
Trenton Wood Specialty Co., Stokes Ave. and P. R. R., Trenton, N. J.
Udell Wks., 23th and Barnes Ave., Indianapolis, Ind.
United Reproducers Corp., 25 Leighton Ave., Rochester, N. Y.
West Box Co., 235 Liberty, Springfield, Mass
Wood Cabinet Corp., 196 Lexington Ave., New York., N. Y.
CABLE ARMORING MACHINES. See Wire Manufacturing Machines
CABLE TEST SETS. See Instruments, Portable and Switchboard.
CABLING MACHINES. See Wire Manufacturing Machines

CANDLES, Fixture
Glass, Fibre Paper.
Brandywine Fibre Products Co., 1402 Walnut, Wilmington.
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Fibre Products Co., New Bedford, Mass.
Franklin Fibre Specialty Co., 173 Lafayette, New York, N.Y.
Phoenix Glass Co., Monaca, Pa.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Seamless. See Fibre Products Co.
CANOPY (Canopies). See Fixture Fittings.
Insulators. See Insulators.
Switches. See Switches, Snap.
CAPACITORS, RADIO. See Radio Circuit Components.

CARBON, Powdered
Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich
CARBONS, Battery. See Carbons.
Arc Light. See Carbons.

CARBONS
Battery Arc Light.
Becker Bros. Elecl. Corp., 23 N. Jefferson, Chicago, Ill.
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.
Columbia. See National Carbon Co.
Daylight. See National Carbon Co.
Lessing Battery. See Blanck & Carrier Corp.
Nuernberg Battery. See Blanck & Carrier Corp.
National Carbon Co., Cleveland, Ohio.
Oretip. See National Carbon Co.
Silvertip. See National Carbon Co.
Speer Carbon Co., St. Mary's, Pa.
Stackpole Carbon Co., St. Mary's, Pa.
CARTONS. See Boxes and Wrappers.
CASEIN PLASTICS. See Molded Insulation.
CASES, Eliminator. See Cases, Eliminator.
Flashlight. See Cases, Flashlight.

CASES, Eliminator
Brumberger Co., 252 Pearl, New York, N. Y.
Grand Sheet Metal Wks., 176 Grand, New York, N. Y.
Karp Metal Products Co., 129 30th, Brooklyn.

CASES, Flashlight
Bridgeport Brass Co., 744 E. Main, Bridgeport, Conn.
Lincoln Fibre Specialty Co., Newport, Del.
St. Louis Paper Can & Tube Co., St. Louis, Mo.
Underwood Battery Co., 1250 Ontario, Cleveland, O.
CASTINGS, Aluminum. See Castings, Aluminum. Also
Castings, Copper, etc.
Brass. See Castings.
Bronze. See Castings.
Copper. See Castings.
Die. See Castings, Die.
Monel Metal. See Castings.
Steel. See Castings, Steel.
White Metal. See Castings.

CASTINGS, Aluminum
Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Berks Foundry & Mfg. Co., West Hamberg, Pa.
Bohm Aluminum & Brass Corp., Detroit, Mich.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Dick Bros., Inc., Reading, Pa.
Eureka Metal Products Corp., North East, Pa.
Monarch Aluminum Ware Co., 9301 Detroit Ave., Cleveland.
National Bronze & Aluminum Foundry Co., 88th & Lay, Cleveland, O.
Quality Aluminum Casting Co., Waukesha, Wis.
Tenual. See National Bronze & Aluminum Foundry Co.
Veco Mfg. Co., South Norwalk, Conn.

CASTINGS
Copper, Brass, Bronze, Monel Metal, White Metal.
Anderson Mfg. Co., Albert & J. M., 239 A, Boston, Mass.
Berks Foundry & Mfg. Co., West Hamberg, Pa.
Bohn Aluminum & Brass Corp., Detroit.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Bridgeport Castings Co., 250 North Ave., Bridgeport, Conn.
Central Pattern & Foundry Co., 3737 S. Sacramento Ave., Chicago, Ill.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Hardware Foundry Co., North Chicago, Ill.
Davis & Zuckerman, 514 E. 11th, New York, N. Y.
Delta Star Electric Co., 2437 Fulton, Chicago, Ill.
Dick Bros., Inc., Reading, Pa.
Eureka Metal Products Corp., North East, Pa.
Faries Mfg. Co Decatur, Ill.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit.
Harsch, John, Bronze & Foundry Co., 11612 Madison Ave., Cleveland, O.

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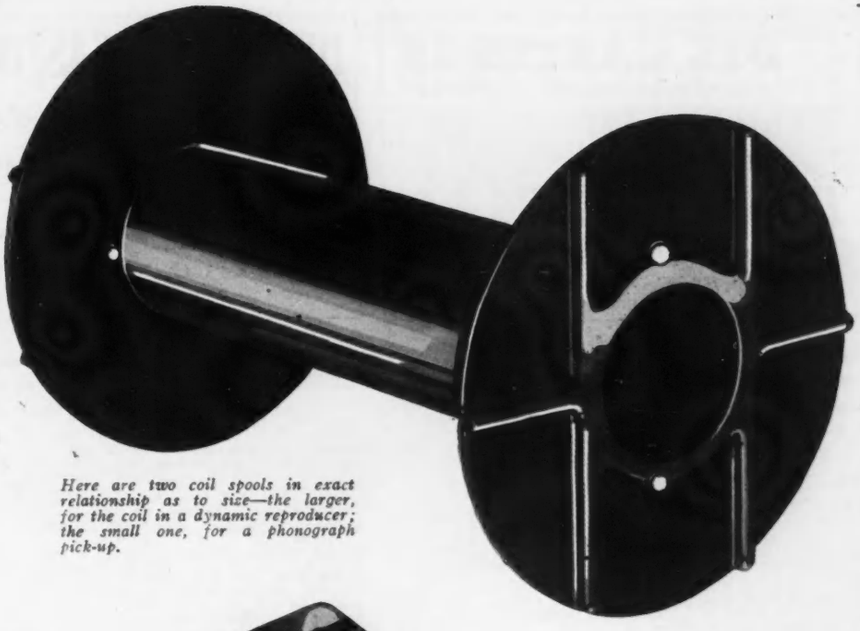

Here are two coil spools in exact relationship as to size—the larger, for the coil in a dynamic reproducer; the small one, for a phonograph pick-up.

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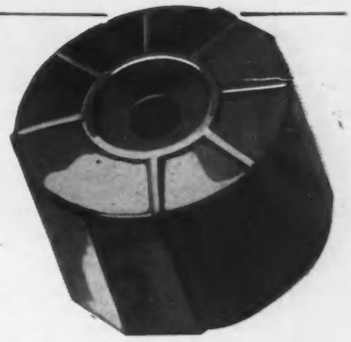

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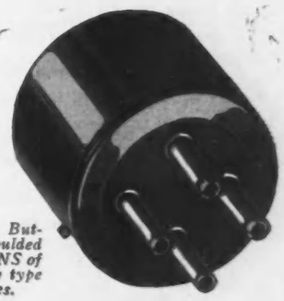

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Ohio Pattern Wks. & Fdy. Co., 2730 Spring Grove Ave., Cincinnati, O.
Reburn Bronze Foundry, 617 West Belgrave, Huntington Park, Cal.
Sterling Art Metal Wks., 40 Purvis, Long Island City, N. Y.
Tenual. See National Bronze & Aluminum Foundry Co.

CASTINGS, Die

Advance Tool & Die Casting Co., 1654 Holton, Milwaukee, Wis.
Alemite Die-Casting & Mfg. Co., 2640 Belmont Ave., Chicago, Ill.
Allied Die-Casting Corp., Long Island City, N. Y.
Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh
Aluminum Industries Inc., 2438 Beekman, Cincinnati, O.
American Brass Co., Waterbury, Conn.
Anaconda. See American Brass Co.
American Die Casting Co., 2040 Dominick, Chicago, Ill.
Badger Die Casting Co., 158 East Buffalo, Milwaukee, Wis.
Barnhardt Bros. & Spindler, Monroe & Throop St., Chicago
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bohnalite. See Bohn Aluminum & Brass Corp.
Bo-Di. See Doehler Die Casting Co.
Doehler Die Casting Co., 386 Fourth Ave., New York, N. Y.
Federal-Mogul Corp., Shoemaker & Lillibridge Sts., Detroit.
Franklin Die Casting Corp., 826 Gifford, Syracuse, N. Y.
Ulinois Die Castings Co., 551 W. Congress, Chicago, Ill.
Krone-Seebek Die Casting & Mfg. Co., 2935 W. 47th, Chicago, Ill.
Milwaukee Die Casting Co., 289 Fourth, Milwaukee, Wis.
Newton Die Casting Corp., 146 Munson, New Haven Conn.
Paragon Die Casting Co., 2701 N. Crawford Ave., Chicago.
Perfection Die Casting Corp., 406 Lakeside Ave., N. W. Cleveland, O.
Permite. See Aluminum Industries, Inc.
Phoenix Die Castings Co., 21 Illinois, Buffalo, N. Y.
Stewart Die Casting Co., 4500 Fullerton Ave., Chicago, Ill.
Superior Die Casting Co., 875 E. 70th, Cleveland, Ohio
Twin City Die Castings Co., Talmadge and 33rd Aves., S. E., Minneapolis, Minn. (White Metal).

CASTINGS, Gray Iron

American Engineering Co., Philadelphia, Pa.
Athens Foundry Co., Athens, Pa.
Barlow Foundry Co., 351 N. J. B. R. Ave., Newark, N. J.
Barnett Foundry Co., Newark, N. J.
Berks Foundry & Mfg. Co., West Hamberg, Pa.
Bonnell Elec. Mfg. Co., 192 Chambers, New York, N. Y.
Bridgeport Castings Co., 250 North Ave., Bridgeport, Conn.
Chicago Hardware Foundry Co., North Chicago, Ill.
Dick Bros., Inc., Reading, Pa.
Eastern Malleable Iron Co., Naugatuck, Conn.
Fairmount Foundry, Inc., Third & Westmoreland Sts., Philadelphia, Pa.
Furst City-Walworth Run Foundries Co., 2500 W. 27th, Cleveland, O.
Gray Iron Foundry Co., Reading, Pa.
Milwaukee Grey Iron Foundry Co., 2910 Mitchell, Milwaukee, Wis.
North Lebanon Foundry Co., Second & Canal, Lebanon, Pa.
North Wales Mach. Foundry Co., North Wales, Pa.
Products Machine Co., Bridgeport, Conn.
Sacks Iron Foundry, L., 357 Wilson Ave., Newark, N. J.
Snead & Co., Pine St., Jersey City, N. J.
St. Louis Malleable Castings Co., 7701 N. Conduit Ave., St. Louis, Mo.
Union Mfg. Co., New Britain, Conn.
Western Foundry Co., Kedzie Ave. at 36th, Chicago, Ill.

CASTINGS, Steel

Bonney-Floyd Co., Columbus, Ohio.
Eastern Steel Casting Co., Ave. L & Edward St., Newark.
Northwestern Steel & Iron Corp., 2907 Fourth, S. E., Minneapolis, Minn.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Procian. See Northwestern Steel & Iron Corp.
Riverside Steel Casting Co., Jacobus Ave., Kearney, N. J.

CEMENT, Commutator

Anchorlute. See Technical Products Co.
Commutator Companion. See Withington Div. of Marnot Co.
Conductalute. See Technical Products Co.
Early, Edward E., 1129 W. Fifth, N. W., Canton, O.
Fixkwick. See Technical Products Co.
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Mitchell Rand Mfg. Co., 19 Vesey, New York, N. Y.

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Technical Products Co., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Withington Div. of Marnot Co., 50 Thayer, Boston, Mass.

CEMENT, Liquid Porcelain

Anchorlute. See Technical Products Co.
Fire Lute. See Technical Products Co.
Insa-Lute. See Technical Products Co.
Okonite Co., Passaic, N. J.
Patch-O-Namel. See Technical Products Co.
Rexmlret Mfg. Co., Milwaukee, Wis.
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.
Technical Products Co., Pittsburgh, Pa.
Thermoid. See Technical Products Co.
CHAIN, Chandelier (Fancy). See Crystals, Chandelier
CHAIN DRIVES. See Chain, Power Transmission

CHAIN, Fixture

Acme. See American Chain Co.
American Chain Co., Bridgeport, Conn.
Chase Brass & Copper Co.
Eastern Chair Works, 309 E. 22nd St., New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Globe Metal Mfg. Co., 2122 E. Hazard, Philadelphia, Pa.
H. & O. Chain Co., So. Norwalk, Conn.
Newark Metal Mfg. Co., 22 S. 6th, Newark, N. J.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rodale Mfg. Co., 290 Hudson, New York, N. Y.
Steele & Johnson Mfg. Co., Waterbury, Conn.
Universal Metal Chain Co., 75 Clymer, Brooklyn, N. Y.

CHAIN, Power Transmission

Baldwin Chain & Mfg. Co., Worcester, Mass.
Boston Gear Wks. Sales Co., Norfolk Downs, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Company, 910 S. Michigan Ave., Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Reeves Pulley Co., Columbus, Ind.
Renold Boston. See Boston Gear Wks.
Union Chain & Mfg. Co., Sandusky, O.
Whitney Mfg. Co., Hartford, Conn.

CHAIN, Socket

American Ball Chain Works, 12 Wooster St., New York.
Bead Chain Mfg. Co., Bridgeport, Conn.
H. & O. Chain Co., South Norwalk, Conn.
CHANDELIER BEADS. See Crystals, Chandelier.
CHANDELIER CRYSTALS. See Crystals, Chandelier
CHANDELIER FRINGE. See Crystals, Chandelier

CHARGERS, Magnet

Charging, Remagnetizing.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Cowie Elec. Co., E. S., 1823 Wyandotte, Kansas City, Mo.
Fore Elec. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.
Scintilla Magneto Co., Inc., Sidney, N. Y.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago.
Valley Electric Co., 4231 Forest Park Blvd., St. Louis, Mo.

CHEMICALS, Battery

Electrolyte, Battery Salts, Battery Oxides, Sal Ammoniac, Bluestone, Manganese.
Cooper & Co., Charles, 194 Worth, New York, N. Y.
Eagle-Picher Lead Co., 134 N. LaSalle, Chicago. (Oxide.)
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Electrex. See Goodyear Chemical Co., Inc.
Electro Chemical Co., 113 W. Court St., Dayton, O.
General Metallic Oxides Co., Jersey City, N. J.
Globe Chemical Co., Murray Rd. and Big Four R. R., Cincinnati, O.
Goodyear Chemical Co., Inc., 20 W. 22nd, New York, N. Y.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Kalbfleisch Corp., 200 5th Ave., New York, N. Y.
Klipstein Co., 644 Greenwich, New York, N. Y.
Merrimac Chemical Co., 148 State, Boston, Mass.
Powers-Weightman-Rosengarten Co., Philadelphia, Pa.
Voltah. See Powers-Weightman-Rosengarten Co.
Wah Chang Trading Corp., 233 Broadway, New York, N. Y.

CHEMICALS, Refrigeration

Ansul Chemical Co., Marinette, Wis.
Arctic. See Roessler & Hasslacher Chemical Co.
Carbide & Carbon Chemicals Corp., 30 E. 42nd, New York, N. Y. (Butane & Isobutane.)
Dry Ice Corp. of America, 50 E. 42nd, New York, N. Y.
Roessler & Hasslacher Chemical Co., 709 Sixth Ave., New York, N. Y. (Methyl Chloride, Ethyl Chloride.)
Virginia Smelting Co., West Norfolk, Va. (Sulphur Dioxide.)
Chromium Plating. See Plating & Finishing.

CHUCKS, Magnetic

J & H Elec. Co., 161 Clifford, Providence, R. I.
Simmons. See Taft-Pierce Mfg. Co.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S. (Rockdale), Worcester, Mass.

CIRCUIT BREAKERS

Air and Oil Circuit Breakers and Oil Break Switches
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Anderson Mfg Co., Albert & J. M., 289 A, Boston, Mass.
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Automatic Switch Co., 617 E. Larned, Detroit, Mich.
Burke Controller Co., 869 Lexington Ave., New York, N. Y.
Cendit Elec'l Mfg. Corp., 838 Summer St. (South Boston) Boston, Mass.
Cramblett Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn.
Hart & Hegeman Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Hartman Electrical Mfg. Co., 31 E. Fifth, Mansfield, Ohio.
High Tension Elecl. Specialty Co., 500 Washington, Abington, Mass.
Hitesco. See High Tension Elecl. Specialty Co.

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H. & H. See Hart & Hegeman Div.
Inducto-therm. See Allen-Bradley Co.
I. T. E. Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia, Pa.
Line Material Co., South Milwaukee, Wis. (Oil Switches.)
Maple Co., R. H., Indianapolis, Ind.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Minibraker. See Burke Controller Co.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sentinel. See Westinghouse Elec. & Mfg. Co.
Takamine Corp., 209 Rawson, Long Island City, N. Y.
U-Re-Lite. See I. T. E. Circuit Breaker Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
CIRCUIT TESTERS. See Testers, Fuse and Circuit.
CLEANER BAGS, Vacuum. See Bags, Vacuum Cleaner.
CLEANER BRUSHES, Vacuum. See Brushes for Vacuum Cleaners.

CLEANERS, Metal

Dukite Products, Inc., 26 Thames, New York, N. Y.
CLIPS, Fuse. See Fuse Clips.

CLIPS, Heater Plug

Gray Bros. Co., Plano, Ill.
CLOCK SWITCHES. See Switches, Time.
CLOTH GEARS. See Gears and Pinions, Composition.
CLOTH LOUD SPEAKER DIAPHRAGM. See Cloth, Untreated
CLOTH RADIO GRILL. See Cloth, Untreated.

CLOTH, Untreated

Doyle & Co., John, 112 Duane, New York, N. Y.
Canvas, "Aeroplane Cloth," Cotton Duck, Drill, Diaphragm Cloth, Grill Fabrics, etc.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pindall Fabrics Corp., 200 Madison Ave., New York, N. Y. (Grill Cloth).

CLOTH AND PAPER, Insulating

Cloth, Insulated ..... See C
Paper, Insulated ..... See I
Fibre Paper (Fish Paper) ..... See F
Press Board (Fuller Board) .... See B
Silk ..... See S

Acme Wire Co., New Haven, Conn. ..... C S P
Armco. See Rogers Paper Mfg. Co.
Armatite. See Mica Insulator Co.
Brand & Co., William, 288 4th Ave., New York ..... P
Campbellite. See National Vulcanized Fibre Co.
Carboloid Products Corp., 15 Park Row, New York, N. Y. ..... C P
Case Brothers, Inc., Highland, Park, Conn. ..... P B
Case Mfg. Co., Unionville, Conn. ..... P
Case & Risley Press Paper Co., Oneco, Conn. ..... P
Celoron Co., Bridgeport Pa. ..... P F B
C-F. See National Vulcanized Fibre Co.
Chicago Mica Co., 345 Campbell, Valparaiso, Ind. C
Columbian Rope Co., Auburn, N. Y. ..... P
Continental-Diamond Fibre Co., Bridgeport, Pa. ..... P
De Jonge & Co., Louis, 69 Duane, New York, N. Y. (Condenser) ..... P
Dexstar. See Dexter & Sons.
Dexter & Sons, C. H., Windsor Locks, Conn (Condenser Tissue.)
Dielectric Mfg. Co., St. Louis, Mo. ..... C S P B
Electrite. See West Virginia Pulp & Paper Co.
Fiberoid. See Wilmington Fibre Specialty Co.
General Electric Co., Merchandise Dept., Bridgeport, Conn. ..... C P
Merchandise Dept., Bridgeport, Conn. ..... C P
Hartford City Paper Co., Hartford City, Ind. (Glassine Condenser Tissue).
Hewitt & Bros., C. B., 16 Ferry, New York C P
Hi-Tex. See Stevens Paper Mills.
Incella. See Tarentum Paper Mills Co.
Irvington Varnish & Insulator Co., Irvington, N. J. ..... C S P
Manning Paper Co., J. A., Troy, N. Y. ..... B
Mica Insulator Co., 200 Varick, New York C S P B
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. ..... P
National Vulcanized Fibre Co., Wilmington, Del. ..... F
New Jersey Wood Finishing Co., Woodbridge, N. J. C
Ohmeld. See Wilmington Fibre Specialty Co.
Old Hick. See Hewitt & Bros., C. B.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass. ..... F
Rogers Paper Mfg. Co., South Manchester, Conn. ..... B

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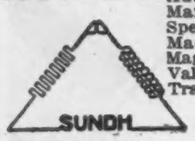

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CLOTH AND PAPER, Insulating—Continued
Schwaltzer, Jno., Peter J., 299 Fifth Ave., New York, N. Y. (Condenser Tissue.)
Sico. See Standard Insulation Co.
Standard Insulation Co., East Rutherford, N. J. ..... C S P . . . .
Sterling Fireboard Co., 501 Fifth Ave., New York. (Varnished Hard Fibreboard)..... . . . . B
Sterlite. See Sterling Firebrand Co.
Stevens Paper Mills, Windsor, Conn..... . . . . B
Tarentum Paper Mills Co., Tarentum, Pa.. . . . . P . . .
Turbonite. See Brand & Co., Wm.
Union Mills Paper Mfg. Co., New Hope, Pa. . . . . P . . .
Warren Mfg. Co., 343 Madison Ave., New York, N. Y. .... P . . .
West Virginia Pulp & Paper Co., 230 Park Ave., New York..... . . . . B
Wilmington Fibre Specialty Co., Wilmington, Del. .... P . . .

CLUTCHES, Magnetic
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.

COIL (Coils).
Armature and Field. See Coils, Finished.
Choke (Power). See Fittings, High Tension.
Choke (Radio). See Radio Circuit Components.
Driers & Impregnators. See Ovens.
Electromagnet. See Coils, Finished.
Flatteners. See Rolls, Coil Flattening.
High Frequency. See Electro-Therapeutic; also Radio Circuit Components; also Ignition Outfits.
Impregnators, Vacuum. See Ovens, Industrial.
Induction. See Coils, Finished; also Electro-Therapeutic
Loop Benders. See Benders, Coil Loop.
Medical. See Electro-Therapeutic.
Presses. See Presses, Armature Coil.
Radio. See Radio Circuit Components.
Removers. See Removers, Coil.
Resistance. See Units, Rods & Grids; also Radio Circuit Components.
Shaping Machines. See Shaping Machines, Coil.
Spark. See Ignition Outfits.
Spreaders. See Winding Machines, Armature & Field Coil.
Tamping Tools. See Tools, Coil Tamping.
Taping Machines. See Taping Machines, Coil.
Testers. See Testers, Coil; also Test Benches, Armature
Winders, Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Winders, Induction Coil. See Winding Machines, Industrial Coil.
Winding Forms. See Forms, Coil Winding.
Windings (Magneto). See Coils, Finished.
Wire Tension Devices. See Tension Devices, Coil Wire

COILS, Finished
Armature, Field, Electromagnet and Induction Coils.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero-Call. See Aero Products, Inc.
Aero Products, Inc., 4611 Ravenswood Ave., Chicago, Ill.
Auth Electrical Specialty Co., 422 E. 53rd St., New York.
A. & A. See Electrical Coil Winding Co.
Belden Mfg. Co., 2510B S. Western Ave., Chicago, Ill.
Bunnell & Co., J. H., 32 Park Place, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cameron Elec. Mfg. Co., Ansonia, Conn.
Cote Coil Div. of Universal Winding Co., Providence, R. I.
Ditmar Elec. Co., Brookline, Mass.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne.
Easton Coil Co., Easton, Pa.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electric Valve Mfg. Co., 68 Murray, New York, N. Y.
Electrical Coil Winding Co., 2735 Saunders, Camden.
Electrical Products Mfg. Co., Providence, R. I.
Fredericks Co., H. M., Lock Haven, Pa.
Globe Technolian Corp., Reading, Mass.
Herald Electric Co., 29 East End Ave., New York, N. Y.
Inca Mfg. Co., Fort Wayne, Ind.
Marion Elec. Mfg. Co., 24 Cliff, Jersey City, N. J.
Modern Elec Mfg. Co., 312 Mulberry, Toledo, Ohio.
National Elec. Corp., 220 High, Newark, N. J.
Pifer Elec. Repair & Mfg. Co., 3610 Superior Ave., Cleveland, O.
Polymet Mfg. Co., 829 E. 134th St., New York, N. Y.
Robertson-Davis Co., 861 W. Superior, Chicago, Ill.
Robertson, Leo F., Inc., 532 West 22nd St., New York, N. Y.
Rome Wire Co. (Div of General Cable Corp.), Rome, N. Y.
Sevisor Magneto Engrg Co 397 Phillips, Toledo, O.
States Co., 19 New Park Ave., Hartford, Conn.
Stuns & Barron, 210 E. Pratt, Baltimore, Md.
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Bars. See Bars, Commutator.
Cement. See Cement, Commutator.
Dressers. See Stones, Commutator.
Lubricants. See Compounds, Commutator.
New. See Commutators.
Refilled. See Repairing and Second Hand.
Slotters. See Slotting Machines & Tools, Commutator
Slotting Files. See Files, Commutator Slotting.
Soldering Machines. See Soldering Machines, Commutator
Stones. See Stones, Commutator.
Tighteners. See Tighteners, Commutator.
Truing Devices. See Tools, Commutator Truing.

COMMUTATORS
Derby Commutator Co., Derby, Conn.
Electric Materials Co., North East, Pa.
Eureka Metal Products Corp., North East, Pa.
Homer Commutator Co., 4748 Hough Ave., N. E., Cleveland, O.
Toledo Standard Commutator Co., Toledo, O.

COMMUTATOR BRUSHES. See Brushes, Commutator.
COMPOSITION PULLEYS. See Pulleys, Composition.

COMPOUNDS, Commutator
Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill.
Armstrong. See Elec. Power Maintenance.
Consistency. See Warren Lubricant Co.
Dixon Crucible Co., Jos., Jersey City, N. J.
Doe & Co., Walter S., Kent, Ohio.
Gales. See McLennan & Co.
Goldmark Co., James, 83 Warren, New York, N. Y.
Kester Solder Co., 4210 Wrightwood Ave., Chicago, Ill.
McLennan & Co., K., 1751 West 35th, Chicago.
Perfection. See Warren Lubricant Co.
Sanderson. See Warren Lubricant Co.
Spermo. See Warren Lubricant Co.
Trotters. See Goldmark Co., James.
Warren Lubricant Co., 22 Maurice, Buffalo, N. Y.
COMPOUNDS, Sealing. See Wax and Compounds.

CONDENSER UNITS, Refrigerator
Bush Mfg. Co., Hartford, Conn.
McCord Radiator & Mfg. Co., Riopelle & E. Grand Ave., Detroit, Mich.
Rome-Turney Radiator Co., Rome, N. Y.
CONDENSERS, Radio. See Radio Circuit Components.
CONDENSER TUBING. See Tubing, Brass and Copper.

CONNECTORS, Pin-Plug
Kliegl Bros. Universal Electric Stage Ltg. Co., 321 W. 50th, New York, N. Y.

CONNECTORS, Wire
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill. (Solderless-Tapeless).
CONTACT POINTS. See Points, Contact.
CONTAINERS, Shipping. See Fibre Board Products.

CONTROLLERS, Motor
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Anderson & Co., C. J., 53 W. Jackson Blvd., Chicago, Ill.
Automatic Switch Co., 154 Grand, New York, N. Y.
Betts, Inc., James H., 1893 Sedgwick Ave., New York, N. Y. (Traffic.)
Burke Controller Co., 369 Lexington Ave., New York.
B-Q Oil Burner Co., Stockton, Cal.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston, Boston, Mass.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Diamond Elect. Mfg. Co., 1330 N. 16th, Los Angeles, Cal.
Dinkey. See Elec. Contreller & Mfg. Co.
E C & M Youngstown. See Electric Controller & Mfg. Co.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electrita. See Sundh Elec. Co.
General Electric Co., Schenectady, N. Y.
Horni Signal Mfg. Corp., 515 Greenwich, New York.
Industrial Controller Div. of Square D Co., S. Pierce & Hanover, Milwaukee, Wis.
Maimin Speed Control Corp., 251 W. 19th, New York. (Sewing Machines.)
Monitor Controller Co., 51 Gay, Baltimore, Md.
National Electric Controller Co., 5315 Ravenswood Ave. Chicago, Ill.
Refrigerating Specialties Co., 728 S. Sacramento Blvd. Chicago, Ill.
Resisto. See Allen-Bradley Co.
Rowan Controller Co., 506 N. Holliday, Baltimore, Md.
Square D Co., 6060 Rivard, Detroit, Mich.
Sundh Elec. Co., Parkhurst St. at Ave. C. Newark, N. J.
Switcholene. See Condit Elec. Mfg. Co.
Thermaload. See Monitor Controller Co.
Trumbull Electric Mfg. Co., Plainville, Conn.
Uemco. See Union Elec. Mfg. Co.
Unelco. See Union Elec. Mfg. Co.
Union Elec. Mfg. Co., 934 Juneau Ave., Milwaukee, Wis.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
W. K. See Westinghouse Elec. & Mfg. Co.
COPPER. See Brass, Bronze and Copper; also Castings
COPPER TUBING. See Tubing, Brass and Copper
CORD TIPS. See Tips, Cord.
CORD, Tinsel. See Tinsel Cord & Thread.

CORDS, Extension
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.

CORES, RESISTANCE COIL (Lava)
American Lava Corp., 1425 William, Chattanooga, Tenn.
Crescent. See M. Kirchberger & Co.
Ex-El-Co. See Southern Lava Co.
Kirchberger & Co., M., 1425 37th, Brooklyn, N. Y.
Lavite. See Steward Mfg. Co.
Lavarock. See M. Kirchberger & Co.
Southern Lava Co., Rossville, Ga.
Steward Mfg. Co., D. M., Chattanooga, Tenn.
Tennessee Burner Mfg. Co., Chattanooga, Tenn.
XL. See Tennessee Burner Mfg. Co.

CORES, RESISTANCE COIL (Refractory Porcelain)
American Lava Corp., 1425 William, Chattanooga, Tenn.
Colonial Insulator Co., Akron, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Elemite. See Louthan Mfg. Co.
Fireite. See Hartford Faience Co.
Hartford Faience Co., Hartford, Conn.
Louthan Mfg. Co., E. Liverpool, O.
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.
Thermal Syndicate, 58 Schenectady Ave., Brooklyn, N. Y.
Vitreosil. See Thermal Syndicate.
Woolley, Inc., W. Douglas, East Liverpool, O.
COTTON DUCK. See Cloth, Untreated.
COTTON SLEEVING. See Tape, Cotton.
COUNTERS, Revolution. See Tachometers.

COUPLINGS, Shaft (Flexible-Insulated)
Ajax Flexible Coupling Co., Westfield, N. Y.
Bartlett Hayward Co., Baltimore, Md.
Bond Co., Charles, 617 Arch, Philadelphia, Pa.
Brown Engineering Co., 123 N. Third, Reading, Pa.
Falk Corp., Milwaukee, Wis.
Delbee Rubber Co., Syracuse, N. Y.
Francke. See Smith & Serrell.
General Electric Co., Schenectady, N. Y.
Grundy. See Bond Co.
Kanti Lever. See Brown Engineering Co.
Krone-Seebek Die Casting & Mfg. Co., 2935 W. 47th, Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Lovejoy Tool Wks., 325 W. Ohio, Chicago, Ill.
Mather. See Bond Co.
Nuttall Wks., of Westinghouse Elec. & Mfg. Co., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Oneida. See Delbee Rubber Co.
Smith & Serrell, 5 Halsey, Newark, N. J.
Webster Mfg. Co., 1356 N. Kostner Ave., Chicago, Ill.
Wood's Sons Co., T. B., Chambersburg, Pa.
COVERING MACHINES, WIRE. See Wire Manufacturing Machines.

CUPS, Grease
Bowen Products Corp., Auburn, New York.
Gits Bros. Mfg. Co., 1960 S. Kilbourn Ave., Chicago, Ill.
Lunkenheimer Co., Cincinnati, Ohio.

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CRANES, Floor. See Lifts, Armature.

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Crystals, Prisms, Beads, Chains, Fringes.
Crystal Venetia. See Harrison & Co., Arthur.
Foslite. See Harrison & Co., Arthur.
Friedlaender Co., 49 W. 23rd, New York, N. Y.
Harrison & Co., Arthur, 561 W. Washington Blvd., Chicago.
Hirschberg, Shutz & Co., 368 4th Ave., New York, N. Y (Fringes.)
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Rialto Import Co., 112 W. 4th, New York, N. Y.
Schwartz Lighting Fixture Wks., 1341 Noble, Philadelphia.
Wyle & Bros., J. J., 20 E. 27th, New York, N. Y.
CURRENT INDICATORS. See Instruments, Pocket.
DASHBOARD METERS. See Instruments, Portable and Switchboard.

DECALCOMANIA
Meyercord Co., 120 S. La Salle, Chicago, Ill.
Novar. See Palm Fechteler & Co.
Palm Fechteler & Co., 67 5th Ave., New York, N. Y.

DIALS
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Enameled. See Dials, Enameled.

DIALS, Enameled
Whittier Co., Horace E., Pequabuck, Conn.
DIAPHRAGM, Cloth. See Cloth, Untreated.
DIE CASTINGS. See Castings, Die.
DIE MAKERS. See Dies, Die Makers.

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Baumbach Mfg. Co., 1810 Kilbourn Ave., Chicago, Ill.
Danly Machine Specialties, Inc., 2104 S. 52nd Ave., Chicago, Ill.
DIES, Pipe. See Stocks, Dies and Reamers.

DIES, DIE MAKERS
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Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Mareck & Nebel, 255 Greenwich, New York, N. Y.

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American Stamping Co., 978 E. 64th, Cleveland, O.
Cleveland Armature Works, 4732 St. Clair Ave., Cleveland.
Hercules Elec. Steel Corp., 145 Lafayette, New York, N. Y.
Lamination Stamping Co., 764 Windsor, Hartford, Conn.
Niagara Machine & Tool Wks., 637 Northland, Buffalo, N. Y.
Valley Appliances, Inc., 634 Lexington Ave., Rochester, N. Y.
Willor Mfg. Corp., 117 Mercer, New York, N. Y.
DRAWING MACHINES, WIRE. See Wire Drawing Machines.
DRIVE SCREWS. See Screws, Drive.
DRIVES, CHAIN. See Chain, Power Transmission.

DYNAMOMETERS
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Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Diehl Mfg. Co., Elizabeth, N. J.
General Electric Co. Schenectady,
EBONITE. See Rubber, Hard.
ELECTROLYTE. See Chemicals, Battery.
ELECTROMAGNETS. See Coils, Finished.

ELECTRODES FOR GAS SIGNS
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Eisler Electric Corp., 756 S. 13th, Newark, N. J.
Manhattan Elecl. Supply Co., 510 Sixth Ave., New York.
Q. R. S. De Vry Corp., 333 N. Michigan Ave., Chicago, Ill.
ELECTRODYNAMOMETERS. See Instruments, Laboratory Standard.
ELEMENTS, Heating. See Units, Rods and Grids.

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American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.

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Deckel. See Preis & Co., Inc., H. P.
Eisler Electric Corp., 756 S. 13th, Newark, N. J.
(Tube Base Branders)
Engravograph Corp., 12 Vestry, New York, N. Y.
Etchograph. See Brewster Co., Wm.
Gilbert Supply Co., Independence, Iowa.
Gorton Machine Co., Geo., Racine, Wis.
Preis & Co., Inc., H. P. Newark, N. J
Schmidt, Inc., Geo. T., 4100 Ravenswood Ave., Chicago, Ill.

ENGRAVING, Radio Panel
Engraving to Order.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Etch-O-Gravure. See Insuline Corp. of America.
General Fabricating Co., 165 Greenwich, New York, N. Y.
Globe Mfg. Co., 101 Spokane St., Seattle, Wash.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
New England Products Co., 232 Greenwich, New York.
Preis & Co., Inc., H. P., 227 Fulton, New York, N. Y.
Schwenke Machine Engraving Co., 2036 Woodward Ave., Detroit, Mich.
Verichrome Laboratories, 4614 Spring Grove Ave., Cincinnati.
Wright Radio Co., 114 Exchange, Rockland, Mass.

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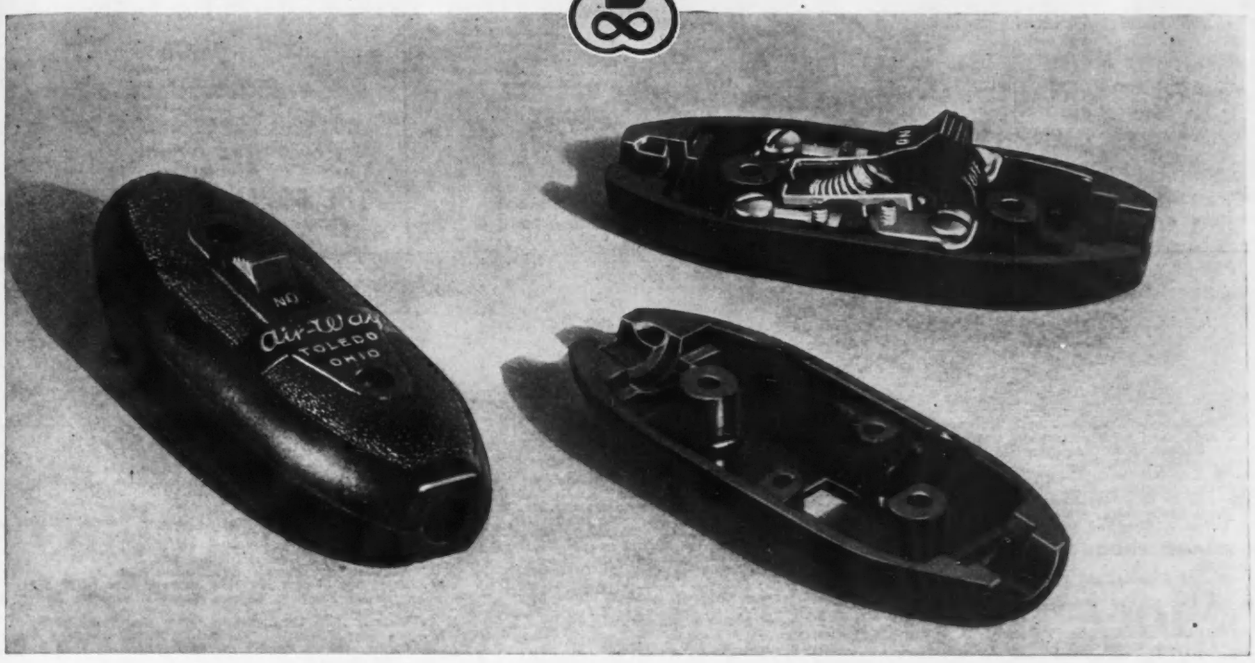
Platt Bros. & Co., Waterbury, Conn.
Waterbury Button & Moulding Co., 835 S. Main, Waterbury, Conn.
Waterbury Button Co., 835 S. Main, Waterbury, Conn.
FABRIC, Radio Grill. See Cloth, Untreated.
FABRIC SHADES. See Shades, Fabric.
FAN BLADES. See Blades, Fan.



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Booth Felt Co., 460 18th, Brooklyn, N. Y.
Brawley, T. R., 279 20th, Brooklyn, N. Y.
Western Felt Wks., 4029 Ogden Ave., Chicago, Ill.

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Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, 490 Hancock Ave., Bridgeport, Conn.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Massachusetts Machine Shop, Inc., Boston, Mass.
Patton-MacGuyer Co., Providence, R. I.
Platt Bros. & Co., Waterbury, Conn.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., 99 Mill, Waterbury, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
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FIBRE BOARD PRODUCTS (Solid and Corrugated)
Container Corp. of America, 111 W. Washington, Dept. 34, Chicago, Ill.
Mid-West Box Co., 111 W. Washington, Chicago.
Sorton Mfg. Corp., 59 E. Madison, Chicago, Ill.

FIBER CANDLES. See Candles, Fixture.
FIBRE GEARS. See Gears and Pinions, Composition.
Paper. See Cloth and Paper.
Radio Panels. See Radio Molded Parts.
Shipping Containers. See Fibre Board Products.
Vulcanized. See Fibre, Vulcanized.

FIBRE, Phenol
Moisture Proof; Sheet, Rod, Tubes.
Aico. See American Insulator Corp.
American Insulator Corp., New Freedom, Pa.
Amerine. See American Insulator Corp.
Armite. See Spaulding Fibre Co.
Bakelite-Dilecto. See Continental Fibre Co.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Campbellite. See Campbell Fibre Co.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Fibroc Insulation Co., 430 Lincoln Ave., Valparaiso, Ind.
Formica Insulation Co., 4628 Spring Grove Ave., Cincinnati, O.
Franklin Fibre Specialty Co., Wilmington, Del.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Phenolite. See National Vulcanized Fibre Co.
Spaulding Fibre Co., Tonawanda, N. Y.
Synthane Corp., Oaks, Pa.
Vul-Cot. See National Vulcanized Fibre Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

FIBRE, Vulcanized
Sheet, Rod, Tube, Horn, Fibre, Bushings, Washers, Cleats, Screw Machine Products.
Brandywine Fibre Products Co., 1402 Walnut St., Wilmington, Del.
Conite. See Continental-Diamond Fibre Co.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Del.
Diamond F. See Continental-Diamond Fibre Co.
Egyptian. See Delaware Hard Fibre Co.
Electrosote. See Pantasote Co.
Fibre Products Co., New Bedford, Mass.
Franklin Fibre Specialty Co., Wilmington, Del.
Fyberoid. See Wilmington Fibre Specialty Co.
Independent Laboratories, 50 E. 42nd, New York, N. Y.
Iten Fibre Co., 5403 Bower Ave., Cleveland, O.
Leatheroid. See Rogers Fibre Co.
Lincoln Fibre & Specialty Co., Newport, Del.
National Vulcanized Fibre Co., Wilmington, Del.
Ohmold. See Wilmington Fibre Specialty Co.
Pantasote Co., Inc., 250 Park Ave., New York, N. Y.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass.
Spaulding Fibre Co., Tonawanda, N. Y.
Standard Fibre Products Co., 36 Pleasant, Watertown, Mass.
Vul-Cot. See National Vulcanized Fibre Co.
Vulcaswood. See Continental-Diamond Fibre Co.
Wilmington Fibre Specialty Co., Wilmington, Del.

FIBRE WASHERS. See Fibre.
FIELD COILS. See Coils, Finished.

FILAMENTS, Incandescent Lamp
Cohn, Sigmund, 44 Gold, New York, N. Y.
Conneway Elec. Laboratories, 466 Jefferson St., Hoboken.
Filament Supply Co., 1317 Willow Ave., Hoboken, N. J.
Gilby Wire Co., Riverside Ave., Newark, N. J.
National-Harris Wire Co., 195 Verona Ave., Newark, N. J.
Suter & Nuetzi, 3709½ Lisbon Ave., Milwaukee, Wis.
Vacuum Tube Products, Steneck Trust Bldg., Hoboken, N. J.
Volkmar & Sons, 187 Sylvan Ave., Newark, N. J.
(Lead-in-Welds.)

FILES, Commutator Slotting
Ideal Commutator Dresser Co., 1039 Park, Sycamore, Ill.
Martindale Electric Co., 1262 W. Fourth, Cleveland, O.

FISH PAPER. See Cloth and Paper.
FITTINGS, Fixture. See Fixture Fittings.
FIXTURE CANDLES. See Candles, Fixture.
FIXTURE CHAIN. See Chain, Fixture.
FIXTURE, Collars. See Fixture Fittings.

FIXTURE FITTINGS

KEY
Bowl Holders	See B
Brass Fittings	See B
Canopies	See B
Collars	See B
Crow Feet	See I
Finials (Brass, Glass and Porcelain)	See B
Hangers	See H
Hickies, Brass	See B
Hickies, Iron	See I
Hooks, Brass	See B
Hooks, Iron	See I
Iron Fittings	See I
Loops, Brass	See B
Loops, Iron	See I
Rings	See B
Shade Holders	See S
Shells	See B
Spinnings	See B
Stampings	See B
Stems	See B
Straps	See H
Studs	See I

Acme Lighting Products, Inc., 2114 Woodland Ave., Cleveland, O. Straps ..... H
American Chain Co., Bridgeport, Conn. (Loops and Rings.) ..... B
American Ring Co., Waterbury, Conn. (Candle.) ..... S
Appleton Electric Co., 1703 Wellington Ave., Chicago, Ill. ..... B I
Arco. See American Ring Co.
Arrow Electric Division of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... S
Artoloid. See Great Eastern Brass Wks., Inc.
Art Metal Co., 3721 Dayton, Cleveland, O. ..... H
Bakelite. See East Side Metal Spinning Co.
Banner. See Plume & Atwood Mfg. Co.
Barton Brass Wks., 3627 Superior, Detroit. ..... B
Belmet. See B. & L. Metal Stamping Co.
Bloch Bros., 88 Walker, New York ..... B
Brandt Mfg. Co., 3727 Gratiot Ave., Detroit. ..... B
Braun, J. G., 609 S. Pauline, Chicago, Ill. (Pressed Ornaments.) ..... B I
B. & L. Metal Stamping Co., 250 Moore, Brooklyn, N. Y. (Also Combination Wall Bracket Hanger.) ..... B I H
Cambridge Brass Co., Cambridge, Mass. ..... B
Chase Brass & Copper Co., Waterbury, Conn. ..... B S
Chatham Metal Spinning & Stamping Corp., 128 Mott, New York, N. Y. ..... B I
Cleaneesy. See Dunlap Co.
Colonial Stamping Co., Brill St. & Passaic Ave., Newark, N. J. ..... B S
Crescent Brass Mfg. Co., Reading, Pa. ..... B
Crouse-Hinds, Solvay Sta., Syracuse, N. Y. ..... S H
Diamond Needle & Mfg. Co., Torrington, Conn. (Hickies.) I
Dunlap Co., John, Carnegie, Pa. ..... S
East Side Metal Spinning Co., 451 Greenwich, New York, N. Y. ..... B
Eureka Tin Ware Mfg. Co., 135 W. 20th, New York, N. Y. ..... S
E-Z Up. See Plume & Atwood Mfg. Co.
Faries Mfg. Co., Decatur, Ill. ..... B I S H
Flaherty Co., M. E., 28 S. Clinton, Chicago. I
Fralick Co., S. R., 15 S. Clinton, Chicago. I
Franklin Brass Foundry Co., Reading, Pa. ..... B
Friedley-Voshardt Co., Chicago. ..... B
Grabler Mfg. Co., 6565 Broadway, S. E., Cleveland, O. I
Great Eastern Brass Wks., Inc., 182 Grand, New York, N. Y. (Spindles).
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... S
Incandescent Supply Co., 468 West Broadway, New York, N. Y. ..... B H
Isco. See Incandescent Supply Co.
Jiffy. See White Mfg. Co., J. H.
Kwikon. See Fralick Co., S. R.
Lakin. See Thomas & Betts Co.
Liberty Brass Turning Co., 88 Walker, New York, N. Y. I
Liberty Iron Pipe & Nipple Works, 62 Greene, New York, N. Y. ..... B I
Liberty Machine Co., Wauwatosa, Wis. ..... B I
Light Metal Stamping Co., 310 13th St., West New York, N. J. ..... S
L & K Mfg. Co., 440 Adelphi, Brooklyn, N. Y. ..... H
L. & W. Brass Wks., 361 W. Superior, Chicago, Ill. ..... B
Madelite. See Belson Mfg. Co.
M. S. W. Mfg. Co., 1527 Niagara Ave., Buffalo, N. Y. I
Meta. Products Co., 210 Canal, New York ..... B
Metro Iron Ornament Co., 191 Christie, New York, N. Y. I
Metropolitan-Columbia Mfg. Co., 714 Metropolitan Ave., Brooklyn, N. Y. ..... B
Midwest Elec. Co., 1639 Walnut, Chicago, Ill. I
Mid-West Chandelier Co., 14th & Chestnut Sts., Kansas City, Mo. ..... B
Mitchell-Vance Co., 70 Washington, Brooklyn, N. Y. ..... S
Monarch. See Perfecfite Co.
Murlin Mfg. Co., Philadelphia, Pa. ..... B I
National Electric Products Corp., Pittsburgh, Pa. (Studs.) I
New Era Elec. Mfg. Co., 6725 Machinery Ave., N. E., Cleveland, O. ..... H
New Wrinkle. See Bryant Elec. Co.
New York Brass Turning Co., 568 Broadway, New York, N. Y. ..... B
Noblit. See Fralick & Co., S. R.
N. W. Cleat Receptacle Bracket, 2437 N. 29th, Philadelphia, Pa. I
Onli. See Perfecfite Co.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. ..... B S
Perfecfite Co., 1457 E. 40th, Cleveland ..... S
Pittsburgh Valve & Fittings Co., Barberton, O. I
Plume & Atwood Mfg. Co., Waterbury, Conn. ..... B S H
Plumwood. See Plume & Atwood Mfg. Co.
Plymouth. See Vester Sons, Alfred.
Products Machine Co., Bridgeport, Conn. ..... B
Reading Brass Co., 141 Schiller, Reading, Pa. ..... B I
Ribaysen Mfg. Co., J., 952 W. Lake, Chicago, Ill. ..... B
Rosale Mfg. Co., 200 Hudson, New York ..... B H
Sandow Tool Co., 1440 Bway, New York, N. Y. ..... S
Scovill Mfg. Co., Waterbury, Conn. ..... B I
Simpalite. See Sprecher Mfg. Co., P. W.
Simplex. See Plume & Atwood Mfg. Co.
Springfast. See Plume & Atwood Mfg. Co.
Square-G. See Grabler Mfg. Co.
Standard Snap-Lite Corp., 504 Jackson Ave., Long Island City, N. Y. ..... S
Standard Metal Spinning Co., 128 Mott, New York, N. Y. ..... B
Star. See Perfecfite Co.
Star. See Steel City Elec. Co.
Steel City Elec. Co., Pittsburgh, Pa. I
Steele & Johnson Mfg. Co., Waterbury, Conn. ..... B S
Stembridge & Brandt, 29 S. Clinton, Chicago, Ill. (White Metal.) ..... B
Sterling Spinning & Stamping Wks., 476 Broome, New York, N. Y.
T. & B. See Thomas & Betts Co.
Thomas & Betts Co., 63 Vesey, New York I
Uno. See Bryant Elec. Co., also Crouse-Hinds, also General Elec. Co., also Hart & Hegeman Mfg. Co., also Pass & Seymour.
United. See L & K Mfg. Co.

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CLEVELAND 1302-4-6 ONTARIO ST. CHICAGO 320 WRIGLEY BLDG.

United Metal Spinning Co., 440 Adelphi, Brooklyn, N. Y. ..... B
Vester, Sons, Alfred, 5 Mason, Providence, R. I. ..... B
Victor. See Plume & Atwood Mfg. Co.
Virden, Div. of Gill-Virden Co., 6108 Longfellow Ave., Cleveland, O. ..... B
Walden Tool & Metal Mfg. Co., New Haven Conn. .....
Wameco. See Waterbury Metal Wares Co.
Waterbury Metal Wares Co., Waterbury, Conn. ..... S
Weber Brass Co., Whitney Power Block, Cleveland, O. ..... B
White Diamond. See White Mfg. Co., J. H.
White Mfg. Co., J. H., 79 Madison Ave., New York, N. Y. ..... B S
Wilhite Machine Wks., 1245 S. Hope, Los Angeles, Cal. ..... B

FLASHERS, Sign
Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.
Ajax. See Reynolds Spring Co.
A. & W. See General Outdoor Adv. Co.
Angelus. See Electric Sign Flasher Corp.
Betts, Inc., James H., 1393 Sedgwick Ave., New York. (Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.)
Betts & Betts Corp., 645 W. 43rd, New York, N. Y. (Motor Flashers.) (Thermal Flashers.) Flashing Plugs.)
California Sign Flasher Co., 250 Guttenberg, San Francisco, Cal.
Commercial Elec. Co., 1203 E. Grant, Portland, Ore.
Cramblet Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Diamond. See General Appliance Corp.
Dominic. See Kala-Flasher Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electric Signal Corp., 406 Fourth Ave., Seattle, Wash.
Electric Sign Flasher Corp., 1826 W. 9th, Los Angeles, Cal.
Figuregram. See Reynolds Electric Co.
Flash O-Lite. See Betts, Inc., James H.
Flip-Flop. See Betts, Inc., James H.
Gem Engineering Co., Hempstead, N. Y.
Gacor. See General Appliance Corp.
General Appliance Corp., 120 8th, San Francisco, Cal. (Flasher Button.)
General Controler Co., 200 E. First, Dayton, O.
Grazier Elec'l Products Co., Johnstown, Pa.
Harrington-Seaberg Corp., 1708 Third Ave., Moline, Ill.
Horni Signal Mfg. Co., 516 Greenwich, New York, N. Y.
Jimbetts. See Betts, Inc., James H.
Kala-Flasher Co., 344 N. Church, Kalamazoo, Mich.
Killark. See Betts & Betts Corp.
Kontroler. See General Controler Co.
Mercury. See Betts, Inc., James H.
Opalume Sign System, Battle Creek, Mich.
Phelps Elec. Co., 29 S. Clinton, Chicago, Ill. (Motorless)
Phoenix Products Co., Phoenix, N. Y.
Presto Products Co., 64 University Place, New York, N. Y. (Sockets and Plugs.)
Reco. See Reynolds Elec. Co.
Reynolds Elec. Co., 2050 W. Congress, Chicago, Ill.
Reynolds Spring Co., Jackson, Mich.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Ryan. See Phoenix Products Co.
Skedoodle. See Phelps Elec. Co.
Sokit. See Betts, Inc., James H.
Thermo-Wynk. See Betts & Betts Corp.
Vacu. See Betts & Betts Corp.
Veebar. See Betts, Inc., James H.
Way, Eugene W., Seattle, Wash.
Wood Electric Co., C. D., 565 Broadway, New York, N. Y.
Woodwin. See Wood Elec. Co., C. D.
Wynk-A-Lyte. See Betts & Betts Corp.

FLASHLIGHT LENSES. See Lenses.
FLEXIBLE ARMS. See Tubing, Flexible Metallic.
FLEXIBLE LEADS, Commutator Brush. See Brushes, Commutator.

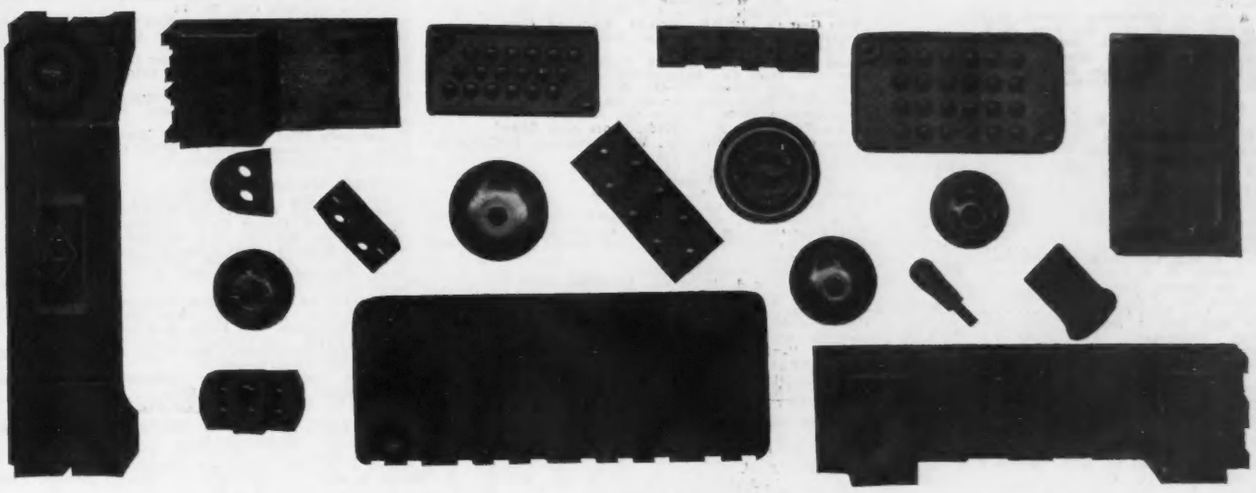
FLEXIBLE SHAFT MACHINES
(For shafting. See Tubing, Flexible Metallic.)
Strand & Co., N. A., 5001 N. Lincoln, Chicago, Ill.

FLUTING MACHINES. See Pleating Machines.

FORGINGS, Non-Ferrous
Scovill Mfg. Co., Waterbury, Conn.

FORMS, Coil Winding
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, O.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Master. See Armature Coil Equipment Co.

FORMS, Wire
Forms and Frames for Shade Holders and Shades: Bending, Welding, Forming.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Arrow Wire Frame Corp., 344 E. 23rd, New York, N. Y.
Blake & Johnson Co., 1497 Thomaston Ave., Waterville, Conn
Central Wire Frame Co., 154 E. 23rd, New York, N. Y. (Complete with socket, cord and plug.)
Chelsea Wire Wks., 675 Hudson, New York, N. Y.
Clark Metal Products Inc., 490 Hancock Ave., Bridgeport Conn.
City Wire Frame Co., 2025 S. Michigan Ave., Chicago.
Electro Weld Co., 70 Munroe, Lynn, Mass.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Jeschke Wire Specialty Wks., Crawfordsville, Ind.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Manhattan Wire Products Co., 398 First Ave., New York.
Murray Hill Wire Frame Co., 314 E. 32nd, New York, N. Y.
Roebling's Sons Co., John A., Trenton, N. J.



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Ambler White Cold Moulded

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Other Ambler Asbestos Products

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Ambler Asbestos Lumber for fireproof construction.

Ambler Asbestos Corrugated Sheets for industrial roofing and siding.

Ambler Asbestos Shingles.

Ambler Asbestos Waltile.

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FORMS, Wire—Continued
Steinen & Co., 297 Washington, Newark, N. J.
Watral & Sons, 132 E. 16th, New York, N. Y.
Young Industries, Inc., L. A., Detroit, Mich.
FRAMES, Wire. See Forms, Wire.
FRICTION TAPE. See Tape, Rubber and Friction.
FRINGE, Chandelier. See Crystals, Chandelier.

FUSE CLIPS

Sherman Mfg. Co., H. B., Battle Creek, Mich.
Waterbury Brass Goods Co., Waterbury, Conn.

FUSE TESTERS. See Testers, Fuse and Circuit.

FUSES AND FUSE WIRE

	KEY
Cartridge	See C
Plug	See P
Non-Refillable	See N
Refillable	See R
Open Link	See O
Fuse Wire	See O

Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. . . . . P
Arkless. See Economy Fuse Mfg. Co.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. . . . . P N
Automatic Elec. Iron & Fuse Co., 215 S. American, Philadelphia, Pa. . . . . P
Buss. See Bussman Mfg. Co.
Bussmann Mfg. Co., University & Jefferson Ave., St. Louis . . . . . C P N R O
Chase-Shawmut Co., Newburyport, Mass. . . . C P N R O
Clearsite. See Economy Fuse & Mfg. Co.
Clear-Top. See Trico Fuse Mfg. Co.
Colortop. See Trico Fuse Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. (Automobile) . . . . . C . . N R
Cote Bros. Mfg. Co., 182 W. Lake, Chicago C P . . R . .
Crystal. See Royal Elec. Co.
Daum Fuse & Elec. Mfg. Co., 1157 Hodgkins, Pittsburgh . . . . . C . . . . R . .
D. & W. See Graybar Electric Co.
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. . . . . C P N R . .
Eco. See Economy Fuse & Mfg. Co.
Electric Fuseguard Co., Charlottesville, Va. . C P N R . .
Elliott Electric Co., Shreveport, La. . . . . .
Gem. See Chicago-Jefferson Fuse & Electric
General Elec. Co., Merchandise Dept., Bridgeport, Conn. . . . . C P N R . .
Graybar Electric Co., Graybar Bldg., Lexington Ave. and 43rd St., New York, N. Y. C . . . . . .
Great Western Fuse Co., 415 Lexington Ave., New York, N. Y. . . . . C . . . . R . .
H. & H. See Hart & Hegeman.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. . . . . P . . R . .
Hudson Wire Co., Ossining, N. Y. . . . . O
Kantark. See Trico Fuse Mfg. Co.
Kirkman Engrg. Co., 1 Dominick St., New York, N. Y. . . . . C P N . . O
Littelfuse Laboratories, 1772 Wilson Ave., Chicago, Ill. (Low Capacity, Glass Enclosed, .025 to 2 Amp.) . . . . . .
Monarch Fuse Co., 116 E. First, Jamestown, N. Y. . . . . C . . N R . .
National. See Economy Fuse & Mfg. Co.
Neark. See Colt's Patent Fire Arms Mfg. Co.
Pierce Renewable Fuses, Inc., 752 Main, Buffalo, N. Y . . . . . C P . . R . .
Platt Bros. & Co., Waterbury, Conn. . . . . O
Powell, F. W., 119 W. Ohio, Pittsburgh . . P . . R . .
Ree-Nu-It Elec. Co., New Bedford, Mass. . C P . . R . .
Rochester Re-Fill Fuse Co., 402 Cottage, Rochester, N. Y. . . . . C . . . R . .
Royal Elec. Co., Chelsea Station, Boston . . P N . . .
Shawmut. See Chase-Shawmut Co.
Simplicity. See Cote Bros. Mfg. Co.
Six-in-One. See Industrial Engrg. Co.
Star Fuse Co., 235 Canal, New York, N. Y. C P . . R . .
Trico Fuse Mfg. Co., 1001 McKinley Ave., Milwaukee . . . . . C P N R . .
Union. See Chicago-Jefferson Fuse & Electric

GALVANIZING

Cattie & Bros., Joseph P., Gaul and Letterly Sts., Philadelphia, Pa.

GALVANOMETERS. See Instruments, Laboratory Standard.

GAS, Inert

Helium Co., Louisville, Ky.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.
Weber, Alfred, 5 Union Square, New York, N. Y.

GAS SIGN ELECTRODES. See Electrodes for Gas Signs

GASKETS, Rubber

Gutta Percha & Rubber Mfg. Co., 15 Park Row, New York.
Canfield Rubber Co., Bridgeport, Conn.

GAUZE BRUSHES, Wire. See Brushes, Commutator.
GEARS, Fibre. See Gears and Pinions, Composition.

GEARS (Speed Changing Units)

Cleveland Worm & Gear Co., Cleveland, Ohio.
Cullman Wheel Co., 1346 Altgild, Chicago, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Falk Corp., Milwaukee, Wis.
Farrell-Birmingham Co., 344 Vielcan, Buffalo, N. Y.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, Ill
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Jones Fdy. & Machine Co., W. A., Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Nuttall Wks., of Westinghouse Elec. & Mfg. Co., McCandless Ave. & Harrison St., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.
Ohio Gear Co., 1333 E. 179th, Cleveland, Ohio.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.
Smith, Winfield H., Springville, N. Y.

GEARS, Worm

Albaugh-Dover Mfg. Co., Chicago, Ill.
Cleveland Worm & Gear Co., Cleveland, Ohio.
Colburn Gear & Mfg. Co. (Norfolk Downs), Quincy, Mass
Ohio Gear Co., 1333 E. 179th, Cleveland, Ohio.
Philadelphia Gear Works, Richmond and Tioga Sts., Philadelphia, Pa.

GEARS AND PINIONS, Composition

Chicago Stock Gear Wks., 105 S. Jefferson, Chicago, Ill.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Delaware.
Fabroil. See General Elec. Co.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago.
Franklin Fibre Specialty Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Medart Co., St. Louis, Mo.

Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Stahl Gear Co., 1390 E. 40th, Cleveland, Ohio.
Stranahan Gear Co., Philadelphia, Pa.
Textoil. See General Electric Co.
Textolite. See General Electric Co.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND PINIONS, Iron and Steel

Earle Gear & Machine Co., Wayne Junction, Philadelphia.
Falk Corp., Milwaukee, Wis.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Medart Co., St. Louis, Mo.
Meisel Bros. Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Machine & Gear Co., 120 Circuit Ave., Springfield, Mass.
Permag. See Perkins Machine.
Tool Steel Gear & Pinion Co., Cincinnati, Ohio.

GEARS AND PINIONS, Rawhide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Gerdes & Co., 50 Church, New York, N. Y.
Syracuse Rawhide Mfg. Co., Syracuse, N. Y.
Western Rawhide & Belting Co., Milwaukee, Wis.

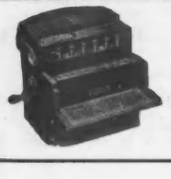
GENERATORS, Electroplating. See Plating Generators.
GLASS BULBS. See Bulbs, Glass.
GLASS CANDLES. See Candles, Fixture.
GLASS LETTERS. See Letters, Sign.

GLASS for Electrical Purposes

Corning Glass Wks., Corning, N. Y.
Pyrex. See Corning Glass Wks.

GLASSWARE

Alba. See Macbeth-Evans Glass Co.
Amazon. See Gleason-Tiebout Glass Co.
Amelites. See Consolidated Lamp & Glass Co.
Apollo. See Gillinder Bros., Inc.
Ardmore. See Jeannette Shade & Novelty Co.
Aurene. See Corning Glass Co.
Aurora. See Consolidated Lamp & Glass Co.
Bagley Sons, 105 Vanderveer, Brooklyn, N. Y.
Beaumont Co., Morgantown, W. Va.
Bellova. See McFaddin & Co., H. G.
Blanco. See Gleason-Tiebout Glass Co.
Berylite. See Plaut & Co., L.
Bostock, Rhodes & Co., 11 N. Moore, New York, N. Y
Camia. See Gleason-Tiebout Glass Co.
Carara. See Gleason-Tiebout Glass Co.
Celestialite. See Gleason-Tiebout Glass Co.
Chesler & Sons Co., J., 43 Varick Ave., Brooklyn, N. Y
Clearcut. See Ivanhoe Division of Miller Co.
Colcita. See Corning Glass Co.
Consolidated Lamp & Glass Co., Coraopolis, Pa.
Cora. See Consolidated Lamp & Glass Co.
Cora-Lites. See Consolidated Lamp & Glass Co.
Corning Glass Co., Corning, N. Y.
Cremax. See Macbeth-Evans Glass Co.
Crystal. See Phoenix Glass Co.
Daylite. See Wells Glass Co.
Delica-White. See Kopp Glass, Inc.
Druid. See Ivanhoe Division of Miller Co.
Eagle Mfg. Co., Wellsburg, W. Va.
Emeralite. See McFaddin, H. G.
Equalite. See Bayley & Sons.
Erskine Glass & Mfg. Co., Wellsburg, W. Va.
Federal Light & Lens Corp., Star City, W. Va.
Florentine. See Gleason-Tiebout Glass Co.
Genco. See Ivanhoe Division of Miller Co.
Gillinder Bros., Inc., Port Jervis, N. Y.
Gillinder & Sons, Inc., Philadelphia, Pa.
Gleason-Tiebout Glass Co., 99 Commercial, Brooklyn, N. Y
Gletieco. See Gleason-Tiebout Glass Co.
Havana. See Kopp Glass, Inc.
Hocking Glass Co., Lancaster, O.
Holophane Co., 342 Madison Ave., New York, N. Y.
Imperial Glass Co., Bellaire, O.
Inland Glass Works, Chicago, Ill.
Ivanhoe Division of Miller Co., Cleveland, Ohio.
Ivory. See Phoenix Glass Co.
Ivre. See Ivanhoe Division of Miller Co.
Jeannette Shade & Novelty Co., Jeannette, Pa.
Jefferson Glass Co., Follansbee, W. Va.
Kaufield Glass & Ceramic Co., Star City, W. Va.
Kopp Glass, Inc., Swissvale, Pa.
Lumina. See Hocking Glass Co.
Luminite. See Macbeth-Evans Glass Co.
Macbeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Magnolia. See Phoenix Glass Co.
McFaddin & Co., H. G., 56 Warren, New York, N. Y.
Melilite. See Gillinder & Sons, Inc.
Micro. See Gillinder & Sons, Inc.
Miller Co., Meriden, Conn.
Monax. See Macbeth-Evans Glass Co.
Moonstone. See Jefferson Glass Co.
N. B. G. See Gillinder & Sons, Inc.
N. U. Glass. See Gillinder & Sons, Inc.
Nebulite. See Gillinder & Sons, Inc.
Nemalite. See Gillinder & Sons, Inc.
Nitro-Glas. See Jefferson Glass Co.
Nuart. See Imperial Glass Co.
Nulite. See Consolidated Lamp & Glass Co.
Nutralux. See Kopp Glass, Inc.
Opalux. See Gleason-Tiebout Glass Co.
Opola. See Inland Glass Co.
Oplex. See Kaufield Glass & Ceramic Co.
Pastelle. See Consolidated Lamp & Glass Co.
Pearitone. See Inland Glass Co.
Persian. See Gillinder & Sons, Inc.
Phoenix Glass Co., Monaca, Pa.
Pilabrasco. See Kopp Glass, Inc.
Pittsburgh Cut Glass Co., Monaca, Pa.
Plaut & Co., L., 432 E. 23rd, New York, N. Y.
Poly-Case. See Gleason-Tiebout Glass Co.
Prestepal. See Gleason-Tiebout Glass Co.
Quezal Glass Mfg. Co., Fresh Pond Rd. and Metropolitan Ave., Brooklyn, N. Y.
Radiant. See Phoenix Glass Co.
Regent. See Ivanhoe Division of Miller Co.
Retelle. See Ivanhoe Division of Miller Co.
Rosedora. See Consolidated Lamp & Glass Co.
Shade-O-Tone. See Consolidated Lamp & Glass Co.
Snow-White. See Inland Glass Works.



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Trojan. See Ivanhoe Div. of Miller Co.
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Utopia. See Kopp Glass, Inc.
Velaria. See Ivanhoe Division of Miller Co.
Vineland Flint Glass Wks., Vineland, N. J.
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Williamsburg Flint Glass Co., 220 Broadway, New York.
Yural. See Ivanhoe Division of Miller Co.
Zanesville Mould Co., Zanesville, O.

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Chase Brass & Copper Co., Waterbury, Conn.
East Hampton Bell Co., East Hampton, Conn.
Gong Bell Mfg. Co., East Hampton, Conn.
Hill Brass Co., M. N., East Hampton, Conn.
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Reiter, G. C., Canton, O.

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GRID LEAKS. See Radio Circuit Components.
GRIDS, Resistance. See Units, Rods and Grids.
GRILL CLOTH. See Cloth, Untreated.
GRINDERS, Commutator. See Tools, Commutator Truing.
GROMMETS. See Eyelets.
GROUND LOCATORS. See Instruments, Portable and Switchboard: also Testers, Coil.
GROWLERS, Armature. See Testers, Coil.

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Fitchburg Enamel Co., Fitchburg, Mass.
Flanders Hardware Co., North Weare, N. H.
Fuller, J. J., Westfield, Mass.
Narragansett Mach. Co., Pawtucket, R. I.
National Wood Process, New Bedford, Mass.
Novelty Turning Co., Norway, Me.
Ober Mfg. Co., Chagrin Falls, O.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O.
Piqua Handle & Mfg. Co., Piqua, Ohio.
Royal Enamel Co., Fitchburg, Mass.
Schutz Bros., 152 Chambers, New York, N. Y.
Stiles & Co., H. A., 174 Portland, Boston, Mass.
Stratton Mfg. Co., Stratton, Maine.
Sun Enamel Wks., Leominster, Mass.

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HOT WIRE METERS. See Instruments, Portable and Switchboard.
IMPREGNATING COMPOUNDS. See Wax and Compounds
IMPREGNATING, VACUUM. See Ovens, Industrial.
INCANDESCENT LAMP BULBS (Unfinished). See Bulbs, Glass.
INCANDESCENT LAMP FILAMENTS. See Filaments Incandescent Lamp.

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Operation and Cost Indicators for Manager's Office.
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Production Meter Co., 1315 S. Wabash Ave., Chicago, Ill.

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INSTRUMENTS, Laboratory Standard. See Instruments, Laboratory Standard.
INSTRUMENTS, Portable Testing. See Instruments, Portable and Switchboard: also Instruments, Pocket.

INSTRUMENTS, Laboratory Standard

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Burt, R. C., 327 Michigan Ave., Pasadena, Cal. (Oscillascopes.)
Cambridge Instrument Co., Grand Central Terminal Bldg., New York, N. Y.
Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago, Ill.
Eppley Laboratory, Newport, R. I. (Standard Cells.)
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General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
Hickok Elec'l Instrument Co., 10514 Dupont, Cleveland, O.
Jagabi. See Biddle, James G.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kasson. See Rawson Elec'l Instrument Co.
Kelvin. See Leeds & Northrup Co.
Kohlrausch. See Leeds & Northrup Co.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Milvay. See Chicago Apparatus Co.
Osiso. See Westinghouse Electric & Mfg. Co.
Radio Elec'l Wks., 50 W. 22nd, New York, N. Y.
Rawson Elec'l Instrument Co., Cambridge, Mass.
Reller-Smith Co., 139 Broadway, New York, N. Y
Rubicon Co., 29 N. Sixth, Philadelphia Pa. (Wheatstone Bridges, Galvanometers, Inductance Condensers, Potentiometers, Resistance Boxes, Permeameters.)
Simplex. See Leeds & Northrup Co.
Strobatchy. See Radio Elec'l Wks.
Stromberg Electric Co., 223 W. Erie, Chicago, Ill.
Thompson-Levering Co., 351 N. 57th St., Philadelphia, Pa
Unipivot. See Rawson Elec'l Inst. Co.
Vreeland Apparatus Co., 140 Cedar, New York, N. Y (Sine Wave Oscillators.)
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elect. Instrument Corp., 583 Frelinghuysen Ave., Newark, N. J.

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Adbro Mfg. Co., 927 French, Pittsburgh, Pa.
Eclipse. See Eldredge Elec'l Corp.
Eldredge Elec'l Corp., 2 P. O. Sq., Springfield, Mass.
Ideal Instrument Co., Penacook, N. H.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Lundquist Tool & Mfg. Co., Worcester, Mass.
Milavolt. See Adbro Mfg. Co.
Readrite Meter Works, 7 College Ave., Bluffton, Ohio.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Shire Elec. Products Co., Marquette Bldg., Detroit, Mich
Sholder-Excel Mfg. Co., Clyde, Ohio.
Square D Company, Detroit, Mich.
Sterling Mfg. Co., 2331 Prospect Ave., Cleveland, Ohio.
Weston Elect. Instrument Corp., 583 Frelinghuysen Ave., Newark, N. J.
Wigginton. See Square D Company.
Yankee. See Lundquist Tool Mfg. Co.

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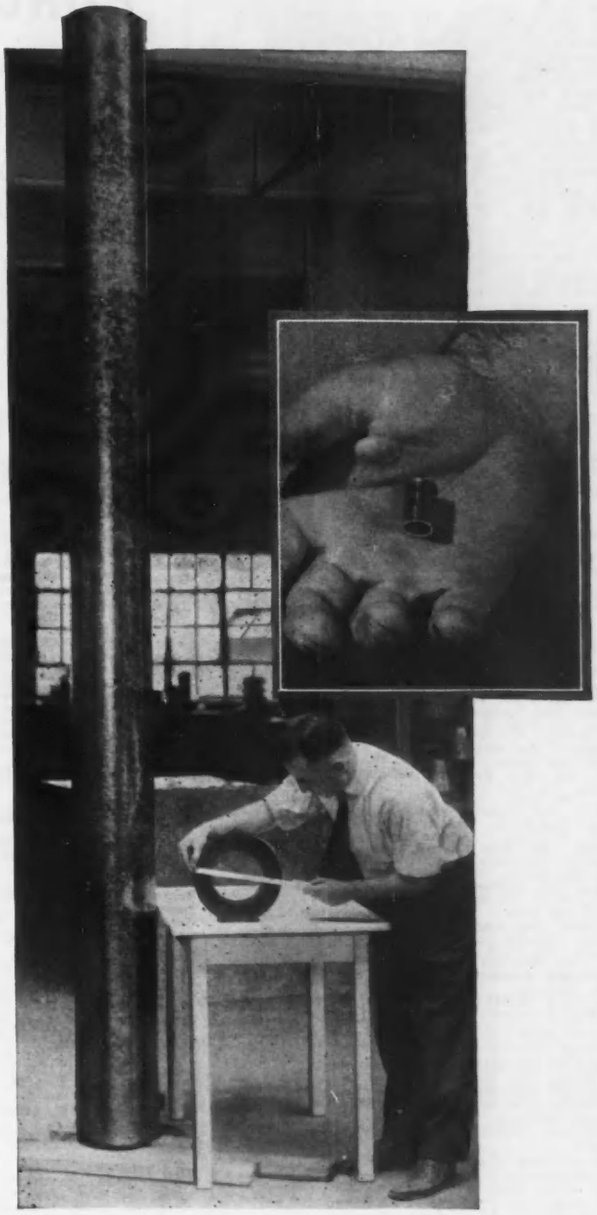

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Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Electric Mfg. Co., 966 Mission, San Francisco, Cal.
Esterline-Angus Co., Speedway, Indianapolis, Ind.
Fidelity Electric Co., Lancaster, Pa.
Fisher Cable Test Sets. See Leeds & Northrup.
Fore Elect. Mfg. Co., 5255 Wabash Ave., St. Louis, Mo.
Freyn Engrg. Co., 310 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
General Radio Co., Cambridge, Mass.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
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Hamilton-Sangamo Corp., Springfield, Ill.
Handy. See Weinberg & Co.
Hickok Elect. Inst. Co., 10514 Dupont, Cleveland, O.
Hoyt Elect. Inst. Wks., 857 Boylston, Boston, Mass.
I T L. See Illinois Testing Laboratories.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Master. See Jewell Elect. Instrument Co.
M. D. C. See Metropolitan Devices Corp.
Megger Testing Sets. See Biddle.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn.
Multi-Volt Trouble Finder. See Welford, Jr., Geo. W.
Nagel Elect. Co., W. G., 23 St. Clair, Toledo, Ohio.
Norton Elect. Inst. Co., 81 Hilliard, Manchester, Conn.
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Peerless Meters. See Thompson-Levering Co.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Pin-Jack. See Weston Elec'l Instrument Co.
Price Hollister Co., Rockford, Ill.
Queen. See Gray Instrument Co.
Radio Electric Works, 150 West 22nd St., New York, N. Y.
Rawson Elect. Inst. Co., Cambridge, Mass.
Roller-Smith Co., 120 Broadway, New York, N. Y.
Shortfinder. See Eisemann Shortfinder Co.
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States Co., Hartford, Conn.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Sticht & Co., H. H., 21 Park Row, New York, N. Y.
Tanner Engrg. Co., Rawson St. and Nelson Ave., Long Island City, N. Y.
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Thompson-Levering Co., 351 N. 9th, Philadelphia, Pa.
Thomson. See General Electric Co.
Triplex Meters. See Roller-Smith Co.
3 in 1. See Sticht & Co., H. H.
Two-in-One. See Stitcht Co., Herman H.
United States Gauge Co., 44 Beaver, New York, N. Y.
Utility. See Esterline-Angus Co.
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elect. Instrument Corp., 583 Freilinghuysen Ave., Newark, N. J.

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Canopy. See Insulators, Canopy.
Cloth. See Cloth & Paper.
Composition. See Molded Insulation.
Compound. See Wax and Comp.
Fibre. See Fibre.
Lava. See Cores, Resistance Coil.
Marble. See Slate.
Mica. See Mica.
Molded. See Molded Insulation.
Paint. See Paint, Varnish, Laquer.
Paper. See Cloth and Paper Insulating.
Phenolic. See Fibre, Phenol. Also Molded Insulation.
Porcelain. See Porcelain.
Rod. See Rubber, Hard.
Rubber. See Rubber, Hard.
Sealing Wax. See Wax and Compounds.
Slate. See Slate.
Soapstone. See Soapstone.
Tubing. See Tubing, Varnished Fabrics.
Varnish. See Paint and Varnish.
Wax. See Wax and Compounds.

INSULATING MACHINES, WIRE. See Wire Manufacturing Machines.
INSULATING TUBING. See Tubing, Varnished Fabric; also Tubing, Rubber.

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INSULATION MIXERS
Baker Perkins Co., Saginaw, Mich.

INSULATION SHEARS. See Shears, Insulation.
INSULATION STRAINING MACHINES. See Wire Manufacturing Machines.
INSULATION TESTERS. See Instruments, Laboratory Standard.

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Continental-Diamond Fibre Co., Bridgeport, Pa.
Franklin Fibre Specialty Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
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Macallen Co., Boston 27, Mass.
Stanley, Arthur F. 150 Varick, New York, N. Y.
Wilmington Fibre Specialty Co., Wilmington, Del.

IRON CASTINGS. See Castings, Gray Iron.
IRONS, Soldering. See Soldering Irons.
JACKS, Armature. See Lifts, Armature.
JACKS, Radio. See Radio Receiver Parts.

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For Composition Jars. See Molded Insulation; also Rubber.
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Cumberland Glass Mfg. Co., Bridgeton, N. J.
Gaynor Glass Works, Salem, N. J.
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Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
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Moser Jewel Co., Perth Amboy, N. J.
Mildrum Jewel Co., East Berlin, Conn.
Sapphire Products Co., 51 Chambers, New York, N. Y.
Universal. See Oeffinger, J. L.
Wennstrom's Sons Co., John, Suffern, N. Y.
Worley Jewel Co., John, Waltham, Mass.

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Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill.
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Sandow Tool Co., 1440 Broadway, New York, N. Y.
Sprecher Mfg. Co., P. W., 3220 North Ave., Milwaukee.
White Co., O. C., 15 Harmon, Worcester, Mass.
Wittenberg Bros., 60 Shipman, Newark, N. J.

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Rheostats. See Rheostats.
Testing. See Testing.

LABORATORY STANDARD INSTRUMENTS. See Instruments, Laboratory Standard.
LACQUER, ARMATURE. See Paint, Varnish and Lacquer Metal. See Paint, Varnish and Lacquer.
LAMINATIONS. See Discs, Armature.
LAMP BASES. See Bases, Reading Lamp.
LAMP BULBS (Unfinished). See Bulbs, Glass.
LAMP FILAMENTS. See Filaments, Incandescent Lamp.
LAMP LEAD-IN WELDS. See Filaments, Incandescent Lamp.
LAMP TESTING PHOTOMETERS. See Photometers, Lamp Testing.

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Hobart Bros. Company, Troy, Ohio. (Test Bench).
South Bend Lathe Works, 425 E. Madison, South Bend, Ind.
Weidennoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

LAVA. See Cores, Resistance Coil.

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American Lead Co., 3112 Penn Ave., Pittsburgh, Pa.
Blatchford Co., E. W., 608 Dearborn, Chicago, Ill.
Columbia Smelting & Refining Wks., 365 West, New York, N. Y.
Eagle-Picher Lead Co., 134 N. LaSalle, Chicago, Ill.
Federated Metals Corp., Woolworth Bldg., New York, N. Y.
Jacobson & Son Co., I. M., 15304 Idaho, Detroit, Mich.
National Lead Co., 111 Broadway, New York, N. Y.
Raymond Lead Co., 735 S. Washtenam Ave., Chicago, Ill.
Turner Lead Co., East St. Louis, Ill.
United Metals Selling Co., 25 Broadway, New York, N. Y.

LEAD-IN WELDS, Lamp. See Filaments, Incandescent Lamp.
LEADS, FLEXIBLE (Commutator Brush). See Brushes, Commutator.

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B. B. T. Corp. of America, Atlantic Bldg., Philadelphia, Pa.
Corning Glass Wks, Corning, N. Y. (Flashlight and Signal.)
Deknatel & Sons, J. A., Queens Village, N. Y.
Goerz American Optical Co., C. P., 317 E. 34th, New York.
Jefferson Glass Co., Follansbee, W. Va. (Sign and Flashlight.)
Kliegl Bros. Universal Stage Ltg. Co., 321 W. 50th, New York, N. Y. (Condensing and Projector.)
Macbeth Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa. (Flashlight.)
North Light Corp., 30 W. 15th, New York, N. Y.
Popper & Sons, Leo, 147 Franklin, New York, N. Y.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill.

Rochester Glass Products, Inc., 29 N. Water, Rochester, N. Y.
Rodefer Glass Co., Bellaire, O. (Flashlight.)
Sneath Glass Co., Hartford City, Ind. (Sign.)
Stromberg-Carlson Telephone Mfg. Co., 1050 University Ave., Rochester, N. Y.

LETTERS, Sign
Glass. Metal.
Adsign Corp, 113 W. 63rd, New York, N. Y.
Chain Products Co., 3924 Cooper Ave., Cleveland, O. (Brass and White Metal.)
Chicago Miniature Lamp Co., 454 W. Lake, Chicago, Ill. (Raised Letters for Signs.)
Eradium. See Pioneer Corporation.
Federal Elec. Co., 8700 S. State, Chicago, Ill. (Metal.)
Grammes & Sons, Inc., L. F., Allentown, Pa.
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Kolux Glass Sales Co., Kokomo, Ind.
Lu-Mi-Nus Signs, Inc., 2736 Wentworth Ave., Chicago, Ill.
Manhattan Elecl. Supply Co., 510 Sixth Ave., New York, N. Y. (For Gas Signs.)
Opalite Corp., 201 E. Ohio, Chicago, Ill.
Pioneer Corporation, 5308 Yale Ave., Chicago. (Luminous.)
Pressed Prism Plate Glass Co., Chicago, Ill. (Glass.)

LIFTS, Armature
Lifts, Hoists, Jacks, Trucks, Buggies, Floor Cranes.
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Duff Mfg. Co., Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.

LININGS, Socket
Remington Mfg. Co., 927 Barnum Ave., Bridgeport, Conn.

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LOOP WINDERS & SPREADERS. See Winding Machines, Armature & Field Coil.
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American Reproducers Co., 1204 Summit Ave., Jersey City, N. J.
A. R. C. See American Reproducers Co.
Amplion. See Woolf, J. W. & W. L.
Balsa Wood Co., 158 Pioneer, Brooklyn, N. Y.
Baritone Mfg. Co., 846 Jackson Blvd., Chicago, Ill.
Brooklyn Metal Stamping Corp., 720 Atlantic Ave., Brooklyn, N. Y. (Electric Pick-up.)
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Cannon & Miller Co., Springwater, N. Y.
Chelten Electric Co., 4859 Stenton Ave., Philadelphia, Pa.
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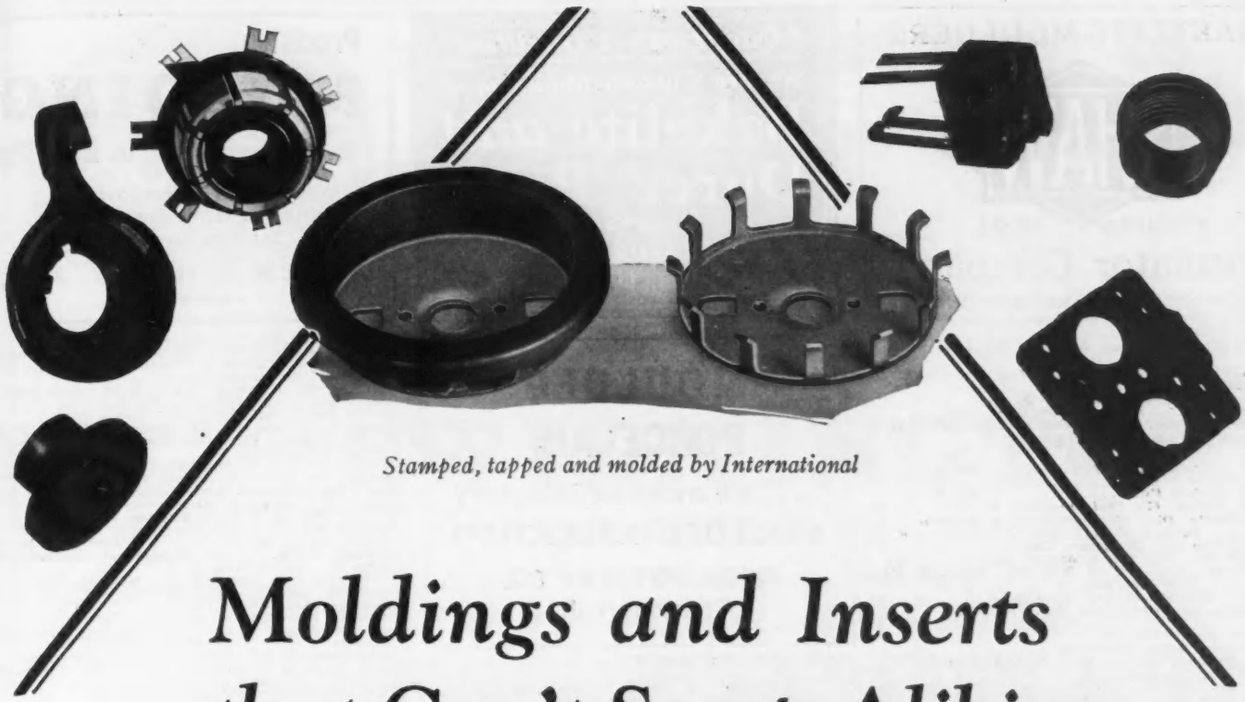
Decatur Mfg. Co., 45 Harman St., Brooklyn, N. Y.
Dreher & Son, Chas., 157 Spring, New York, N. Y.
Dymac. See Electrical Products Mfg. Co.
Electrical Products Mfg. Co., Providence, R. I.
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill. (Units.)
Empire United Hat Block Co., 312 E. 42nd, New York.
Engineers Service Co., 25 Church, New York, N. Y. (Kit.)
Ensco. See Engineers Service Co.
Fenco Cone Co., 57 Murray, New York, N. Y. (Kit.)
Fidelity Radio Corp., Salt Lake City, Utah.
F. & H. Radio Laboratories, Fargo, N. D.
Globe Technolian Corp., Reading, Mass.
G. R. P. See Penn Mfg. Co.
Grutal Speaker Co., 609 E. Walnut, Des Moines, Iowa.
Jensen Radio Mfg. Co., 6601 S. Lavanie Ave., Chicago, Ill.
Kersten Radio Equipment, Inc., 1415 Fillford, Kalamazoo, Mich.
Kyle. See Newcombe-Hawley.
Lata Balsa. See Balsa Wood Co.
Magnavox Co., 4250 Horton, Oakland, Cal. Also Units.
Mandel Electric Co., 2157 N. California Ave., Chicago, Ill.
Markone Radio Mfg. Co., 303 Devoe, Brooklyn, N. Y. (Horn.)
Minuet. See Thompson Radio Co.
Molded Wood Products, 219 W. Chicago Ave., Chicago, Ill.
Newton Elec'l Mfg. Co., Newton, Mass.
O'Neil Mfg. Corp., West New York, N. J.
Operadio Mfg. Co., St. Charles, Ill.
Oxford Radio Corp., 3200 Carroll Ave., Chicago, Ill.
Peerless. See United Reproducers Corp.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa.
Philco. See Philadelphia Storage Battery Co.
Platter Cabinet Co., North Vernon, Ind.
Powerola. See Temple Corp.
Puropower. See Platter Cabinet Co.
Quam Radio Products Co., Div. of United Air Cleaner Corp., 9705 Cottage Grove Ave., Chicago, Ill.
Racon Elec. Co., 18 Washington Place, New York, N. Y. (Horn only.)
Red Lion Cabinet Co., Red Lion, Pa.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Swoboda Co., Maritime Bldg., Seattle, Wash.
Temple Corp., 5253 W. 65th, Chicago, Ill.
Thompson Radio Co., 25 Church, New York, N. Y.
Ultratone Mfg. Co., 1046 W. Van Buren, Chicago, Ill.
United Reproducers Corp., 25 Leighton Ave., Rochester, N. Y.
Universal. High Power Telephone Co., Carleton Ave. and Eddy, Seattle, Wash.
Utah Radio Products Co., 1615 S. Michigan Ave., Chicago, Ill. (Also Piano Unit.)
Victor Radio Corp., 4321 N. Western Ave., Chicago, Ill.
Wondrphone. See Universal High-Power Telephone Co.
Woolf, J. W. & W. L., 133 W. 21st, New York, N. Y.
Wright-De Coster, Inc., St. Paul, Minn.

Spray Finishing Fundamentals

By Paul W. Collins

On page 39 of this issue of ELECTRICAL MANUFACTURING there is one of a series of articles on paint spraying apparatus and materials. The article treats, primarily, on the refinishing of repossessed, trade-in and shop-worn merchandise by dealers and distributors.



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KEY
Luminous Compound .....See C
Pendants (Bulbs) .....See P
Standard Parts .....See S

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Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn..... S P
Bryant Electric Co., Bridgeport, Conn..... P
Connecticut Elec. Mfg. Co., Bridgeport, Conn..... S
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis
Eagelite. See Eagle Elec. Mfg. Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y..... P
General Elec. Co., Merchandise Dept., Bridgeport, Conn..... S P
Glow Lite. See Rodale Mfg. Co.
Glow Tip. See Arrow Electric Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Electric Co., Hartford, Conn..... S P
Hubbell, Inc., Harvey, Bridgeport, Conn..... P
Luma & Luma Lite. See Radium Dial Co.
Radieye. See General Electric Co.
Radium Dial Co., 3532 Forbes, Pittsburgh, Pa.... C P
Reynolds Spring Co., Jackson, Mich..... S
Rodale Mfg. Co., 200 Hudson, New York, N. Y..... P
Seelite. See T. C. Smith & Co.
Smith & Co., T. C., 2915 Powelton Ave., Philadelphia .. P
Spot O Life. See Hart & Hegeman Mfg. Co.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y..... C S P

MACHINE SCREWS. See Screws, Machine.
MACHINE SCREW PRODUCTS. See Screw Machine Products.

MACHINES

Armature Banding. See Banding Machines, Armature
Armature Notching. See Notching Machines, Armature
Balancing. See Balancers, Armature.
Banding. See Banding Machines, Armature.
Cable Armoring. See Wire Manufacturing Machines
Coil Shaping. See Shaping Machines, Coil.
Coil Taping. See Taping Machines, Coil.
Coil Winding. See Winding Machines.
Commutator Slotting. See Mica Undercutters.
Engraving. See Engraving Machines.
Incandescent Lamp Making. See Machines, Lamp Making
Molded Insulation. See Presses, Molded Insulation.
Perforating. See Perforating Machines.
Porcelain Molding. See Presses, Porcelain Molding.
Radio Tube. See Machines, Lamp Making.
Shaping. See Shaping Machines, Coil.
Slotting. See Mica Undercutters.
Soldering. See Soldering Machines, Commutator.
Spring Making. See Spring Making Machines.
Taping. See Taping Machines, Coil.
Tension. See Tension Machines, Band Wire.
Winding. See Winding Machines.
Wire, Armoring. See Wire Manufacturing Machines.
Wire Drawing. See Wire Drawing Machinery.
Wire Insulator. See Wire Manufacturing Machines.
Wire Measuring. See Wire Manufacturing Machines.
Wire Tension. See Tension Machines, Band Wire.
Wire Wrapping. See Wire Wrapping Machines.

MACHINES, Lamp Making

For Making Incandescent Lamps and Vacuum Tubes.
Berrenberg, R., 13 Farnham (Roxbury), Boston, Mass (Vacuum Pumps.)
Cserwenka, Frank, 35 Monroe, Passaic, N. J. (Bombarding Machines.)
Dwyer Machine Co., Lynn, Mass.
Eisler Electric Corp., 770 S. 13th, Newark, N. J.
General Engineering & Supply Co., 160 5th Ave., New York N. Y. (Filament Winder.)
Geseo. See General Engineering & Supply Co.
Radio Elecl. Wks., 150 W. 22nd, New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
York Elec. & Machine Co., 30 Penn, York, Pa.

MACHINES, Bombarding. See Machines, Lamp Making.
MACHINES, Pleating and Fluting. See Pleating Machines.
MACHINES, Spring Making. See Spring Making Machines
MACHINES, WIRE MANUFACTURING. See Wire Manufacturing Machines.
MAGNET CHARGERS. See Chargers, Magnet.
MAGNET STEEL. See Steel, Magnet.
MAGNET TESTERS. See Instruments, Portable and Switchboard; also Instruments, Pocket.
MAGNET WIRE MACHINES. See Enameling Machines for Magnet Wire.
MAGNETIC CHUCKS. See Chucks, Magnetic.
MAGNETIC CLUTCHES. See Clutches, Magnetic.
MAGNETOMETERS. See Instruments, Pocket.

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Rogers Drop Forging Co., Worcester, Mass.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
Sticht & Co., H. H., 21 Park Row, New York, N. Y.
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
Valley Appliances, Inc., 634 Lexington Ave., Rochester, N. Y.

MALLETS, Raw Hide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Crude Pelt. See Chicago Rawhide Mfg. Co.
Holbrook Raw Hide Mfg. Co., 748 N. Main, Providence, R. I.

MANGANESE, Battery. See Chemicals, Battery.
MEASURING INSTRUMENTS. See Instruments.
METAL CUTTING OUTFITS. See Welding and Cutting
MECHANICAL RUBBER GOODS. See Rubber Mechanical Goods.
MEGOHMMETERS. See Instruments, Laboratory Standard
MERCURY SWITCHES. See Switches, Mercury.
METAL CLEANERS (Compound). See Cleaners, Metal.
METAL FINISHING. See Plating & Finishing.
METAL MARKING OUTFITS. See Engraving Machines
METALLIC SHADES. See Shades, Metallic.
METERS. See Instruments.
MICA SHADES. See Shades, Mica.
MICA TAPE. See Tape, Mica.
MICA UNDERCUTTERS. See Slotting Machines & Tools, Commutator.

MICA

Asheville Mica Co., Biltmore, N. C.
Asco. See Schoonmaker Insulation Co.
Brand & Co., William, 268 Fourth Ave., New York, N. Y.
Chicago Mica Co., 345 Campbell, Valparaiso, Ind.
Colonial Mica Co., 126 Seventh, Jersey City, N. J.
Fillion, S. O., 68 Murray, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Gerdau Co., Otto, 533 Canal, New York, N. Y.
Hirsch Mica Co., 1087 Flushing Ave., Brooklyn, N. Y.
Hoyt, Inc., Philip S., Los Tablos, New Mexico.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
International Mica Co., 5660 Brandywine, Philadelphia, Pa.
Kant Krack. See Huse Liberty Mica Co.
Keene Mica Co., Keene, N. H.
Macallen Co., Boston 27, Mass.
Micabond. See Chicago Mica Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Miralite. See Mitchell-Rand Mfg. Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Micanite. See Mica Insulator Co.
Mica Products Mfg. Co., 54 Greene, New York, N. Y.
Munsell & Co., Eugene, 200 Varick, New York, N. Y.
Nemco. See New England Mica Co.
New England Mica Co., Waltham, Mass.
New England Minerals, Inc., 85 Devonshire, Boston, Mass
New York Mica & Mfg. Co., Auburn, N. Y.
Peerless. See New England Mica Co.
Prestonite. See Robt. K. Preston Mica Co.
Preston Mica Co., Robt. K., 957 Monadnock Blk., Chicago. (Ground Mica.)
Red Streak. See Huse Liberty Mica Co.
Rogers-Pyatt Shellac Co., 81 Water St., New York. (Imp.)
Schoonmaker Insulation Co., A. O., 34 University Place, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Watson Bros., 170 Purchase, Boston, Mass.

MINIATURE SWITCHBOARD SYSTEMS. See Instruments, Portable and Switchboard.
MIXERS INSULATION. See Insulation Mixers

MOLDED

Presses. See Presses, Molded Insulation.
Radio Parts. See Radio Molded Parts.
Shades. See Molded Insulation.

MOLDED INSULATION

Alco. See American Insulator Corp.
Allen & Hills, Inc., Auburn, N. Y.
Ambler Asbestos Shingle & Sheathing Co., Ambler, Pa (Cold.)
Ambleroid. See Ambler Asbestos Shingle & Sheathing Co.
American Insulator Corp., New Freedom, Pa.
American Machine & Foundry Co., 5520 Second Ave. Brooklyn, N. Y.
Amerine. See American Insulator Corp.
Anderson Mfg. Co., Albert & J. M., 289 A. Boston, Mass
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Beldenmold. See Belden Mfg. Co.
Bell Mfg. Co., 11 Elkins, Boston, Mass. Radio Parts.
Bettle. See Synthetic Plastics Co., Inc.
Boonton Molding Co., Boonton, N. J.
Boonton Rubber Mfg. Co., 323 Fanny Rd., Boonton, N. J.
Bro-lite Moulding Corp., 109 Hudson, Jersey City, N. J. (Wood Composition.)
Celluloid Corp., 10 E. 40th, New York, N. Y.
Cetelite. See Connecticut Molded Products Corp.
Cetec. See Connecticut Molded Products Corp.
Cepco. See Connecticut Molded Products Corp.
Coltrock. See Colt's Patent Firearms Mfg. Co.
Charmond Elec. Corp., 30 Church, New York, N. Y.
Chicago Molded Products Co., 2140 Walnut, Chicago, Ill.
Cincinnati Molding Co., 2037 Florence Ave., Cincinnati, O.
Colasta Co., Hoosick Falls, N. Y.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Compo-Site, Inc., 207 Astor, Newark, N. J.
Condensite. See Bakelite Corp.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Molded Products Corp., Meriden, Conn. (Cold.)
Continental-Diamond Fibre Co., Bridgeport, Pa.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Dayton Insulating Molding Co., 434 E. First, Dayton, Ohio.
Diemoulding Production Co., Canastota, N. Y.
Dimec. See Dayton Insulating Moulding Co.
Durez. See General Plastics, Inc.
Electrose. See Insulation Mfg. Co.
Erinoid Co., Park Row Bldg., New York, N. Y.
Evercool. See Bakelite Corp.
Formica Insulation Co., 4626 Spring Grove Ave., Cincinnati.
Garfield Mfg. Co., Garfield, N. J. Composition. (Cold.)
General Electric Co., Schenectady, N. Y.
General Moulded Composition Co., 213 Market, Lynn, Mass.
General Plastics, Inc., 99 Walck Rd., N. Tonawanda, N. Y.
Gummor. See Garfield Mfg. Co.
Hahn Mfg. Co., Harry W., 612 S. San Pedro, Los Angeles, Cal.
Herculite. See Colosta Co.
Hi-Heet. See Insulation Mfg. Co.
Imperial Molded Products Co., 2925 W. Harrison, Chicago.
Improco. See Insulation Products Co.
Inda. See American Machine & Foundry Co.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Insulation Products Co., Richland, Pittsburgh, Pa.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
International Insulating Corp., Tyria, O.
Karolith Corp., 189 13th, Long Island City, N. Y. (Cassis plastics.)
Kellite. See Kellogg Switchboard & Supply Co.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Klagges, Chas., 128 147th, Ozone Park, N. Y.
Kuhn & Jacob Machine & Tool Co., 502 Prospect Ave., Trenton, N. J.
Kurz-Kasch Co., Dayton, O.
Lacanite. See Scranton Button Co.
Luco Products Corp., 40 Flatbush Ave. Extension, Brooklyn, N. Y.
Lumarith. See Celluloid Corp.
Luxite. See Wilbur & Williams Co.
Macallen Co., Boston, 27, Mass.
Mack Molding Co., Wayne, N. J.
Makalot. See Johnson Molding & Tool Co.
Megohom. See Waterbury Button Co.
Micarta Fabricators, Inc., 309 Canal, New York, N. Y.
Micarta. See Westinghouse Elec. & Mfg. Co.
Mico. See Molded Insulation Co.
Modern Molded Products Co., Blount and Elm Sts., Providence, R. I.
Molded Insulation Co., Mt. Vernon, N. Y.
New England Products Co., 332 Greenwich, New York, N. Y.
Niagara Insul-Bake Specialty Co., 483 Delaware Ave., Albany, N. Y.
Nixon Nitration Works, Nixon, N. J.
Nixonoid. See Nixon Nitration Works.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Norlac. See Norton Laboratories, Inc.
Northern Industrial Chemical Co., 11 Elkin, South Boston.
Norton Laboratories, Inc., 1025 Mill, Lockport, N. Y.
Panelyte Corp., Trenton, N. J.
Paramix. See Splitdorf Radio Corp.
Paratherm. See Scranton Button Co.
Phenolic. See Scranton Button Co.
Plastic Molding Corp., Sandy Hook, Conn. (Cold.)
Pollopas. See Wilbur & Williams.
Pruven Compositions Products Corp., Milford, Conn.
Pruvenite. See Pruven Composition Products Co.
Pyrolax. See Cutler-Hammer Mfg. Co.
Recto Mfg. Co., 23 W. 3rd, Cincinnati, O.
Redmanol. See Bakelite Corp.
Rezlite. See Northern Industrial Chemical Co.
Reynolds Spring Co., Jackson, Mich.
Reynoldite. See Reynolds Spring Co.
Reynomold. See Reynolds Spring Co.
Richardson Co., Lockland, Cincinnati, O.
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Schneider Bros., Inc., 312 N. Sheldon Ave., Chicago.

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Star Insulate. See Insulation Mfg. Co.
Starlite. See Insulation Mfg. Co.
Stokes & Smith Co., Summerdale Ave. near Roosevelt Blvd. Philadelphia, Pa.
Synthetic Plastic Co., Inc., 535 Fifth Ave., New York, N. Y. (Molding Powder).
Textolite. See General Elec. Co.
Thermoplax. See Cutler-Hammer Mfg. Co.
Tegit. See Garfield Mfg. Co.
Union Insulating Co., Parkersburg, W. Va.
Vulcabeston. See Colt's Patent Fire Arms Mfg. Co.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.
Waterbury Button & Moulding Co., Waterbury, Conn.
Watertown Mfg. Co., Watertown, Conn.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa
Wilbur & Williams Co., 261 Park Square Bldg., Boston, Mass. (Molding Powder.)

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Lohfeld & Co., J. L., 53 Park Place., New York, N. Y.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.
Radiotherma, Inc., 45 E. 17th, New York, N. Y.
Sirian Wire Co., 255 Sherman Ave., Newark, N. J.

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International Nickel Co., 67 Wall, New York, N. Y.

MOTOR CONTROLLERS. See Controllers, Motor.
MOTOR PLATFORM BASES. See Bases, Motor Platform
MOTOR STARTERS. See Controllers, Motor; Switches, Remote Control; Switches, Motor Starting; Safety; Switches Snap (Heavy Duty).

MOTORS

Alternating Current ..... See S
Direct Current ..... See S
Motors, 1 Hp. up ..... See M
Motors Fractional Hp. ..... See F
Universal ..... See U

Actodector. See Century Electric Co.				
Advance Elec. Co., 4311 Maple Ave., St. Louis	M	F	S	..
Allis-Chalmers Mfg. Co., Milwaukee, Wis.	M	..	S	..
Allis Co., Louis, Milwaukee, Wis.	M	..	S	..
American Elec. Motor Co., Cedarburg, Wis.	M	..	..	..
Apex Elec'l Mfg. Co., 1067 E. 152nd, Cleveland	..	F	S	U
Armor Elec. Mfg. Co., 1020 Holland, Erie, Pa.	M	..	..	..
Baldor Elec. Co., 4352 Duncan Ave., St. Louis	M	F	S	..
B-Line. See Brown-Breckmeyer Co.				
Bodine Elec. Co., 2254 Ohio, Chicago	..	F	S	U
Bogus Elec. Co., Chas. J., 132 King, New York	M	..	..	..
Brown-Brockmeyer Co., Norwood Power Bldg., Dayton, O.	M	F	..	..
Burke Elec. Co., Erie, Pa.	M	F	S	t
B. T. See Allis Co., Louis.				
B & B Mfg. Co., 812 Lafayette, Toledo, O.	..	F	..	..
Century Elec. Co., 1806 Pine, St. Louis, Mo.	M	F	S	..
Chandeysson Elec. Co., St. Louis, Mo.	M	..	S	..
Clark, Jr., Elec. Co., James, 600 E. Bergman, Louisville, Ky.	M	..	..	..
Cleveland Armature Wks., 4725 St. Clair Ave., Cleveland, O.	M	..	S	..
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.				
Continental Elec. Co., 14 Magazine, Newark	M	..	S	..
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J.	M	..	S	t
Cushman Elec. Co., Concord N. H.	M	F	S	..
Day-Fan Electric Co., Dept. A, Dayton, O.	..	F	S	..
Diehl Mfg. Co., Elizabeth, N. J.	M	F	S	..
Diverter Pole. See Rochester Elec. Product Co.				
Domestic Electric Co., 7209 St. Clair Ave., Cleveland, O.	..	..	S	U
Dumore Co., 35 16th, Racine, Wis.	..	F	..	U
Eclipse. See Fidelity Elec. Co.				
Electric Machinery Co., Minneapolis, Minn.	M	..	S	..
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O.	..	..	..	..
Electric Specialty Co., 221 South Stamford, Conn.	M	F	S	U
Electro-Dynamic Co., Bayonne, N. J.	M	..	S	..
Emerson Electric Mfg. Co., 2018 Washington Ave., St. Louis, Mo.	M	F	S	U
Engberg's Elec. & Mechl. Works, St. Joseph, Mich.	M	..	S	..
Esco. See Electric Specialty Co.				
Fairbanks-Morse & Co., 900 S. Wabash Ave., Chicago, Ill.	M	F	..	..
Fidelity Elec. Co., Lancaster, Pa.	M	F	S	U
Fitzgerald Mfg. Co., Torrington, Conn.	..	F	..	..
Fynn Weichsel. See Wagner Elec. Corp.				
Galvin Elec. Mfg. Co., 3314 S. Broadway, St. Louis, Mo.	..	F	..	a
General Elec. Co., Schenectady, N. Y.	M	F	S	U
Gilbert Co., A. C., New Haven, Conn.	..	F	..	U
Hamilton Beach Mfg. Co., Racine, Wis.	..	F	S	U
Hobart Bros. Co., Troy, O.	M	..	..	..
Holtzer-Cabot Elec. Co., 125 Amory, Boston	M	F	S	..
Howell Elec. Motors Co., Howell, Mich.	M	..	S	..

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Jants & Leist Elec. Co., Cincinnati, O.	M	F	..	..
Jeannin Electric Co., Fassett & N. Y. C. R. R. Toledo, O.	M	F	S	..
Kendrick & Davis Co., Lebanon, N. H.	..	F	S	..
Kimble Elec. Co., 634 N. Western Ave., Chicago	M	..	S	U
Knapp Elec., Inc., Portchester, N. Y.	..	F	S	U
Leland Elec. Co., Dayton, O.	..	F	S	..
L. E. See Leland Elec. Co.				
Lincoln Elec. Co., Cleveland, Ohio.	M	..	S	..
Line-Weld. See Lincoln Elec. Co.				
Linzee Elec. Motor Co., Mansfield, O.	M	..	..	..
Mando Co., 911 State Tower Bldg., Syracuse, N. Y. (6-12-40 Volt only)	..	F	..	..
Marathon Elec. Mfg. Co., 33 Island, Wausau, Wis.	..	F	..	..
Marble-Card Elec. Co., Gladstone, Mich.	M	..	..	..
Master Electric Co., Dayton, O.	M	F	S	..
MC. See General Electric Co.				
Michigan Elec. & Mfg. Co., Lake Linden, Mich.	..	F	S	..
N. C. See Electric Controller & Mfg. Co.				
Norfolk. See Walter Elec. Mfg. Co.				
North East Elec. Co., Rochester, N. Y.	..	F	..	U
Northwestern Mfg. Co., 480 Clinton, Milwaukee	M	..	..	..
Ohio Elec. & Controller Co., 5903 Maurice Ave., Cleveland, Ohio	..	F	S	..
O. K. See Marathon Elec. Mfg. Co.				
Osann Co., F., 245 Seventh Ave., New York	M	..	..	..
Peerless Elec. Co., 740 W. Market St., Warren, O.	M	F	S	U
Polar Cub. See Gilbert Co., A. C.				
Pow-R-Full. See Wagner Elec. Corp.				
Reco. See Reynolds Electric Co.				
Red Band. See Howell Elec. Motors Co.				
Reliance Elec. & Engrg. Co., 1042 Ivanhoe Rd., Cleveland, O.	M	..	S	..
Reynolds Electric Co., 2650 W. Congress, Chicago	..	F	S	..
Robbins & Myers, Inc., Springfield, O.	M	F	S	U
Standard. See Robbins & Myers Co.				
Star Elec. Motor Co., Miller St. & N. J. R. R. Ave., Newark, N. J.	M	..	S	..
Sterling Elec. Motors, Inc., Telegraph Rd. and Atlantic Blvd., Los Angeles, Cal.	M	..	S	..
Stow Mfg. Co., Binghamton, N. Y.	M	F	S	U
Sturtevant Co., 15 Devonshire (Hyde Park), Boston, Mass.	M	F	S	U
Sunlight Electrical Mfg. Co., Warren, O.	..	F	S	..
Super Wick. See Master Elec. Co.				
Switch start. See Lincoln Elec. Co.				
Union Elec. Motor Mfg. Co., Hancock & Oxford Sts., Philadelphia, Pa.	M	F	S	..
U. S. Elec. Mfg. Co., 200 E. Slawson Ave., Los Angeles	M	..	S	..
Valley Elec. Co., 4221 Forest Park Blvd., St. Louis, Mo.	M	..	S	..
Wagner Elec. Corp., 6400 Plymouth Ave., St. Louis, Mo.	M	F	S	U
Walter Elec. Mfg. Co., Norfolk, Va.	M	..	S	..
Watson See Allis Co., Louis.				
Weico Uniframe. See Weache Elec. Co., B. A.				
Weache Elec. Co., B. A., 1622 Vine, Cincinnati	M	F	S	..
Westinghouse Elec. Mfg. Co., East Pittsburgh	M	F	S	..
Willey-Wray Elec. Co., 1522 Central Parkway, Cincinnati, O.	M	..	S	..
Woods Mach. Co., S. A., Boston	M	F	S	..
Zobell Elec. Motor Co., Garwood, N. J.	M	..	S	..

NAME PLATES

See also Decalcomania.

American Name Plate Co., 117 Imlay, Brooklyn, N. Y.
Angell Embossing Co., 37 Barney-Smith Co., Dayton, O.
Chandler Co., Springfield, Mass.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Electro-Chemical Engraving Co., 52 Vanderbilt Ave., New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y.
Etching Co of America, 1520 Montana, Chicago Ill
General Etching & Mfg. Co., 3070 W. Grand Ave., Chicago, Ill.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Premier Metal Etching Co., 14th & Van Alst Ave., Long Island City, N. J.
Turner Brass Works, Sycamore, Ill.
Waterbury Button & Moulding Co., Waterbury, Conn.

NICKEL

American Mond Nickel Co., Century Bldg., Pittsburgh, Pa
Driver-Harris Co., Harrison, N. J.
International Nickel Co., 67 Wall, New York, N. Y.
National-Harris Wire Co., 195 Verona Ave., Newark, N. J.
Seymour Mfg. Co., Seymour, Conn.
United States Nickel Co., New Brunswick, N. J.

NOTCHING MACHINES, Armature

Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo, N. Y.

NUT SETTING MACHINES

Vim Electric Tool Co., 149 Broadway, New York, N. Y.

OHMMETERS. See Istruments, Laboratory Standard; also Instruments, Portable and Switchboard.
OIL-LESS BEARINGS. See Bearings, Oil-less.
OSCILLOSCOPES. See Instruments, Laboratory Standard

OVENS, Industrial and Laboratory

Annealing. Temper Drawing. Mold Baking. Vulcanising Drying. Conditioning. Enameling, Japanning. Vacuum Impregnating.

Buffalo Fdry. & Machine Co., 1543 Fillmore, Buffalo N. Y. (Armature and Coil.)
Conran, Frederick M., 107 Colden, Newark, N. J.
Crawford Oven Co., New Haven, Conn. (Coil Driers)
Despatch Oven Co., 622 Ninth, S. E., Minneapolis, Minn.
Detroit Sheet Metal Wks., 1341 E. Milwaukee Ave., Detroit, Mich.

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Eberbach & Son Co., Ann Arbor, Mich. (Drying.)
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Emerson Apparatus Co., Melrose, Mass. (Conditioning.)
Freas Thermo Elec. Co., 1206 Grove, Irvington, N. J.
Gehnrich Indirect Heat Oven Co., Long Island City, N. Y.
General Electric Co., Schenectady, N. Y.
Hayes, C. I., 129 Baker, Providence, R. I.
Heidbrink Co., 2633 Fourth Ave., S., Minneapolis, Minn.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Kenworthy, Chas. F., 198 Piedmont, Waterbury, Conn.
Maehler Co., Paul, 2210 Lake, Chicago, Ill.
Miho Co., 717 Sycamore, Cincinnati, O.
Radio Elec'l Wks., 150 W. 22nd, New York, N. Y.
Sargent & Co., E. H., 155 E. Superior, Chicago, Ill.
Sioux Battery & Mfg. Co., Sioux City, Ia. (Battery.)
Snead & Co., Jersey City, N. J.
Standard Elec. Stove Co., Toledo, Ohio.
Steiner & Co., H. E., 197 E. Kinney St., Newark, N. J.
Stokes Machine Co., F. J., 5834 Tabor Rd. (Olney), Philadelphia.
Swartwout Co., 18522 Euclid Ave., Cleveland, O.
Theleo. See Freas Thermo Elec. Co.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Young Bros. Co., 6523 Mack Ave., Detroit, Mich.

OXIDES, Battery. See Chemicals, Battery.

PACKING

Cooke Seal Ring, Dept. R, 45 N. Green St., Chicago, Ill.
Federal Metallic Packing Co., Wakefield, Mass.
Holed-Tite Packing, Inc., 100 E. 42nd, New York, N. Y.
Packtite. See Federal Metallic Packing Co.

PAINT, Varnish, Lacquer KEY

Varnishes, Insulating ..... See V
Painting, Dipping, Spraying, Vacuum Impregnating.
Paint, Insulating and Acid Proof.. See P
Lacquer, Metal Finishing ..... See L

Acme White Lead & Color Wks., 8250 St. Aubin Ave., Detroit, Mich.			L
Ajax. See Sherwin-Williams Co.			
Alaka. See Lacquer & Chemical Corp.			
American Di-Electrics, Ltd., Hancock and Bodine, Long Island City, N. Y.	V	..	..
American Lasatite Co., 3168 Lincoln Ave., Chicago	..	P	L
American Wurtzilite Co., Builders Bldg., Chicago	..	P	..
Antakwa Co., 1329 Mohawk, Chicago, Ill.	..	P	..
Arizona Lacquer Mfg. Co., 7 16th, Brooklyn, N. Y.	..	..	L
Armlac. See Robertson Chemical Co.			
Arolac. See Arizona Lacquer Mfg. Co.			
Art-Craft. See Southwestern Paint & Varnish Co.			
Atlantic Chemical Co., Colt, Irvington, N. J.	..	..	L
Atom Chemical Co., 96 E. 10th, New York, N. Y.	..	..	L
Bakelite Corp., 247 Park Ave., New York, N. Y.	..	..	L
Benolite Varnish Co., 501 Columbia Bank Bldg., Pittsburgh	V	P	..
Berry Bros., Leith & Wight, Detroit, Mich.	V	..	..
Billings-Chapin Co., 1163 E. 40th, Cleveland, O.	V	..	..
Biwax Corp., 208 S. La Salle, Chicago, Ill.	..	P	..
Bradley-Hurtz Co., 2620 S. Dearborn, Chicago, Ill.	..	..	L
Brevolite. See Waukegan Chemical Co.			
Calman & Co., Emil, 42 Vernon Blvd., Long Island City, N. Y.	V	P	..
Carboloid Products Corp., 15 Park Row, New York	V	P	..
Chadeloid Chemical Co., 75 E 45th, New York	V	..	..
Chinalac. See Dolph Co., John C.			
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J.	V	P	..
Code 25. See Mitchell-Rand Mfg. Co.			
Columbus Varnish Co., 564 Cozzens, Columbus, O.	V	..	..
Comulac. See Martindale Elec. Co.			
Continental-Diamond Fibre Co., Bridgeport, Pa.	V	..	..
Day & Co., James B., 1872 Clybourn Ave. Chicago, Ill.	..	P	L
Doe & Co., Walter S., Kent, Ohio.	..	..	..
Dolph Co., John C., 168 Emmet, Newark, N. J.	V	P	..
Duco. See Du Pont de Nemours & Co.			
Du Pont de Nemours & Co., Wilmington, Del.	..	P	..
Durez. See General Plastics.			
Eastman Kodak Co., Rochester, N. Y.	..	..	L
Eclipse Paint & Mfg. Co., Cleveland, O.	..	P	..
E. B. See Mitchell-Rand Mfg. Co.			
Egyptian Lacquer Mfg. Co., 90 West, New York	..	..	L
Electric Lacquer See Dolph Co., John C.			
Enamelac. See Robertson Chemical Co.			
Ever-Brite Products Co., East Liverpool, O.	..	..	L
Ferbert-Schorndorfer Co., 12815 Elmwood Ave., Cleveland, O.	V	P	L
Fesco. See Ferbert-Schorndorfer Co.			
Five Point. See American Wurtzilite Co.			
Franche & Co., 440 Orleans, Chicago, Ill.	..	..	L
General Elec. Co., Merchandise Dept., Bridgeport, Conn.	V	P	..
General Electric Co., Schenectady, N. Y.	..	..	P
General Plastics, Inc., 99 Walck Rd., N. Tonawanda, N. Y.	V	..	..
George Co., P. D., 4153 Bingham Ave., St. Louis, Mo.	V	..	..
G. E. See General Elec. Co.			
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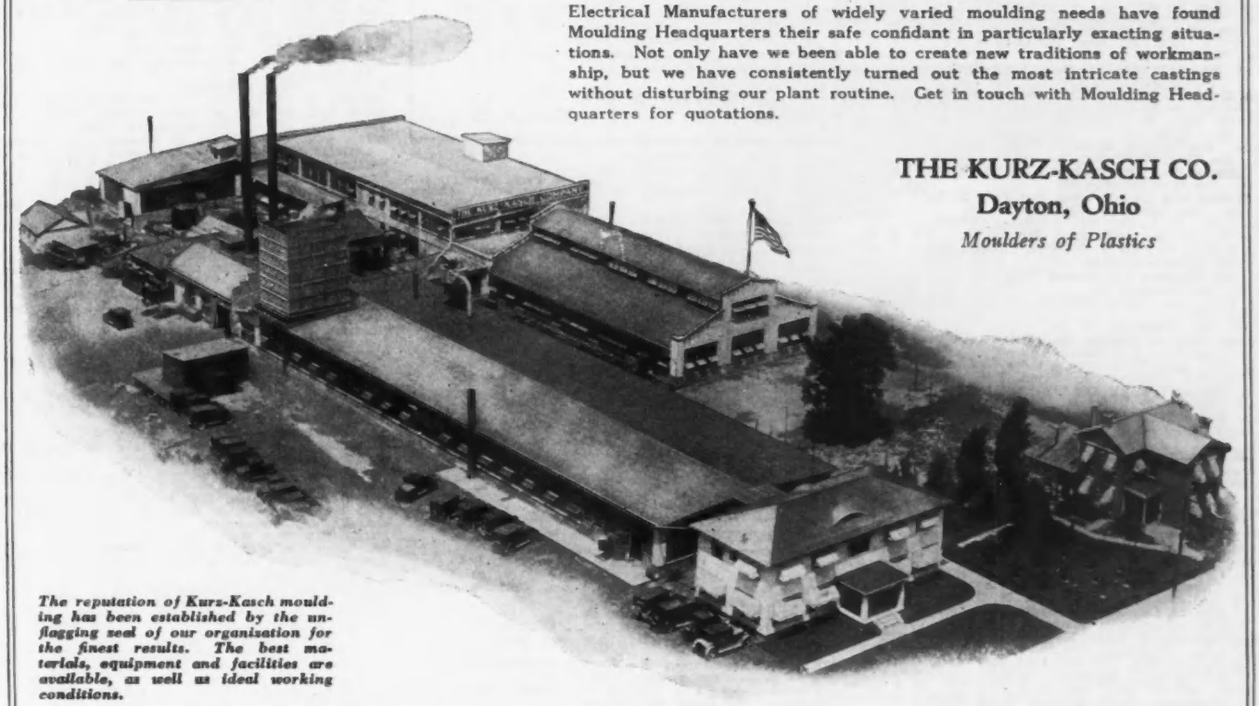

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Insulaterite. See Ohmlac Paint & Refining Co.
Insulvar. See Varflex Corp.
Irvington Varnish & Insulator Co., Irvington, N. J. V P L
Kodalak. See Eastman Kodak Co.
Krakles. See Waukegan Chemical Co.
Lacquer & Chemical Corp., 214-40th St., Brooklyn, N. Y. .. P L
Laqueroid. See Glidden Co.
Liberty. See Antaksa Co.
Linolac. See Mica Insulator Co.
Lowe Bros. Co., 450 E. 3rd, Dayton, O. V P ..
Lucas & Co., John, 232 Race, Philadelphia, Pa. V P ..
Locote. See Lucas & Co., John.
Maas & Waldstein, 438 Riverside Ave., Newark, N. J. L
McDougall-Butler Co., Inc., Evans Water & Norton, Buffalo, N. Y. V P ..
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O. V .. ..
Mawalac. See Maas & Waldstein.
Mecco. See Henry V. Walker Co.
Mica Insulator Co., 200 Varick St., New York.... V .. ..
M. I. C. See Mica Insulator Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. V P ..
Nepto Lac. See Lowe Bros. Co.
Nikolas & Co., G. J., 1227 W. Van Buren, Chicago. L
O'Brien Varnish Co., South Bend, Ind. V P L
Ohmlac Refining Co., 140 S. Dearborn, Chicago, Ill. .. P ..
Opex. See Sherwin-Williams Co.
Ozite. See Standard Underground Cable Co
P. & B. See Ruberoid Co.
Pecora Paint Co., 4th & Sedgeley Ave., Philadelphia, Pa. L
Pedigree. See George Ca., P. D.
Peninsular Paint & Varnish Co., Detroit, Mich. L
Peerless. See Maas & Waldstein Co.
Prexlin. See Acme White Lead & Color Wks.
Pruett-Schaeffer Chemical Co., Taber, Pittsburgh. .. P L
Reliable Leather Dressing Co., 43 Crescent, Long Island City, N. Y. V .. ..
Republic Varnish Co., 200 Thomas, Newark, N. J. V .. ..
Robertson Chemical Co., 9805 Meech Ave., Cleveland, O. V P ..
S. P. C. See Ruberoid Co.
Schenectady Varnish Co., Schenectady, N. Y..... V P ..
Schorndorfer, Ferbert, 12815 Elmwood Ave., Cleveland, O. V P ..
Sherwin-Williams Co., Cleveland, O. V P L
Sipe & Co., James B., Chamber of Commerce Bldg., Pittsburgh, Pa. L
Southwestern Paint & Varnish Co., 610 Broadway, Kansas City, Mo. V P ..
Standard Flexible Comp. Co., 1215 Franklin Trust Bldg., Philadelphia, Pa. V P ..
Standard Insulation Co., Rutherford, N. J. V .. ..
Standard Lacquer Co., 621 Broadway, New York, N. Y. L
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa. .. P ..
Standard Varnish Wks., 443 4th Ave., New York. V P L
Sterling Varnish Co., Haysville, Pa. V .. ..
Toch Bros., 443 4th Ave., New York V P L
Truscon Laboratories, Canift & Grand Trunk Railway, Detroit, Mich. V .. ..
2098. See Mitchell-Rand Mfg. Co.
Varflex Corp., Rome, N. Y. V .. ..
Voltax Co., 99 Reservoir Ave., Bridgeport, Conn. V P ..
Vulcan-Lastite. See American Lastite Co.
Walpole. See Robertson Chemical Co.
Waukegan Chemical Co., North Chicago, Ill. L
Walker Co., Henry V., 17 John St., New York.. L
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa. V P ..
Zapon Co., Stamford, Conn. L
Zelac. See Zeller Lacquer Mfg. Co.
Zeller Lacquer Mfg. Co., 20 E. 49th, New York. L

PANELS (panel) Engraving. See Engraving.
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Radio (Hard Rubber) See Rubber Hard.
Meters. See Instruments, Portable & Switchboard

PAPER

Boxes. See Boxes & Wrappers.
Bushings. See Tubes, Paper.
Candles. See Candles, Fixture.
Cores. See Tubes, Paper.
Fibre. See Cloth and Paper.
Fish. See Cloth & Paper.
Insulating. See Cloth and Paper.
Parchment. See Parchment Paper.
Shades. See Shades, Fabric.
Sleeves. See Tubes, Paper.

PARAFFINE. See Wax and Compounds.

PATENT ATTORNEYS

Sargent, Lester L., 1115 K Street, Washington, D. C.

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Bergstrom Paper Co., Neenah, Wis.
Bradley Mfg. Co., A. J., 101 Beekman, New York, N. Y.
Brown Paper Co., L. L., Adams, Mass.
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago, Ill
De Jonge & Co., Louis, 99 Duane, New York, N. Y.
New York & Penn Co., 200 5th Ave., New York, N. Y.
Paterson Parchment Paper Co., Passaic, N. J.
Raquette River Paper Co., Potsdam, N. Y.
Reeve & Co., Angel H., 7 Spruce, New York, N. Y.
Rogers Paper Mfg. Co., So. Manchester, Conn.
Special Paper Mfg. Co., 96 Reade, New York, N. Y
Strype, Fred C., 140 Lafayette, New York, N. Y.
Taylor-Logan Co., Holyoke, Mass.
Union Paper & Twine Co., 116 St. Clair Ave., N. W., Cleveland, O.
Warren Parchment Co., Dexter, N. Y.
Weber Co., F., 1220 Buttonwood, Philadelphia, Pa.
West Carrollton Parchment Co., West Carrollton, O.
Windsor Locks Paper Mills Co., Windsor Locks, Conn.

PEGS, Armature

Bates & Sons, E. B., 5344 Grand Central Terminal Bldg. New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
National Vulcanized Fibre Co., Wilmington, Del.
Standard Fibre Products Co., 56 Pleasant, Watertown, Mass.
White Supply Co., 4347 Duncan, St. Louis, Mo.

PENS, Scorching

Gilbert Supply Co., Independence, Iowa.
Little Speedster. See Gilbert Supply Co.
Post Elec. Co., 7 E. 44th, New York, N. Y.
Stylectric. See Post Electric Co.

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PHENOLIC INSULATION. See Fibre, Phenol. Also Molded Insulation.

PHOSPHOR BRONZE

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American Brass Co., Waterbury, Conn.
Anaconda. See American Brass Co.
Elephant Brand. See Phosphor-Bronze Smelting Co.
Gilby Wire Co., Riverside Ave., Newark, N. J.
Phosphor-Bronze Smelting Co., 2300 Washington Ave., Philadelphia, Pa.
Scovil Mfg. Co., Waterbury, Conn.
Western Cartridge Co., East Alton, Ill.

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Foto Cell. See Raytheon Mfg. Co.
General Electric Co., Schenectady, N. Y.
G-M Laboratories, Inc., Grace & Ravenswood Ave., Chicago.
Kino-Lamp. See Raytheon Mfg. Co.
National Carbon Co., New York, N. Y.
Photion Instrument Corp., 574 Southern Blvd., New York.
Radio Elec'l Wks., 150 W. 22nd, New York, N. Y.
Visitron. See G-M Laboratories, Inc.
Westinghouse Elec. & Mfg. Co., Mansfield, Ohio.

PHOTOMETERS, Lamp Testing

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Foote, Pierson & Co., 75 Hudson, Newark, N. J.
Holophane Co., 342 Madison Ave., New York, N. Y.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Luxometer. See James G. Biddle.
Matheva. See Foote, Pierson & Co.
National Lamp Wks of G. E. Co., Cleveland, O.

PICK-UPS, TALKING MACHINE. See Loud Speakers.

PIGTAILS, Commutator. See Brushes, Commutator.
Wire Gauze. See Brushes, Commutator.
Vacuum Cleaner. See Brushes for Vacuum Cleaners.
PINIONS. See Gears and Pinions.
PINION PULLERS. See Pullers, Armature Shaft.
PLASTICS. See Molded Insulation.
PLATES, Name. See Name Plates; Also Decalcomanie
Fixture Outlets. See Fixture Fittings.
Storage Battery. See Plates, Storage Battery
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa

PLATES, Storage Battery

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Champion. See Englert Mfg. Co.
C. & B. Battery Co., 1535 S. State, Chicago, Ill.
Edes Mfg. Co., Plymouth, Mass.
Englert Mfg. Co., 2500 Jane, Pittsburgh, Pa.
Exto. See New Jersey Storage Battery Co.
Fort Wayne Battery Mfg. Co., 230 E. Fourth, Ft. Wayne.
Handler. See Witherbee Storage Battery Co.
Link & Henrick, Inc., 555 W. 52nd St., New York, N. Y.
New Jersey Storage Battery Co., 656 Summit Ave., Union City, N. J.
Universal Battery Co., 3410 S. La Salle, Chicago, Ill.
Witherbee Storage Battery Co., 75 Columbus Ave., New York.

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Burke Elec. Co., Erie, Pa.
Century Electric Co., 1806 Pine, St. Louis, Mo.
Chandeysson Elec. Co., St. Louis, Mo.
Connecticut Dynamox Motor Co., Irvington, N. J.
Conpro. See Eager Elec. Co.
Eager Electric Co., 522 Nevell, Watertown, N. Y.
Eclipse. See Fidelity Elec. Co.
Electric Specialty Co., 229 South, Stamford, Conn.
Esco. See Electric Specialty Co.
Fidelity Elec. Co., Lancaster, Pa.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Hobart Bros. Co., Troy, O.
Holtzer-Cabot Elec. Co., 125 Amory, Boston, Mass.
Ideal Electric & Mfg. Co., East Third St., Mansfield, O.
Jantz & Leist Elec. Co., Cincinnati, O.
Kendrick & Davis Co., Lebanon, N. H.
L'Hommedieu & Sons Co., Chas. F., 4521 Ogden Ave., Chicago Ill.
Optimus. See Hanson-Van Winkle & Munning Co.
Reliance. See L'Hommedieu & Sons Co., Chas. F.
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Diamond Chrome. See U. S. Chromium Corp.
Duro Chrome. See General Chromium Corp.
General Chromium Corp., 3220 Bellevue Ave., Detroit, Mich (Chromium Plate.)
Ideal Plating & Polishing Co., 55 Branford, Newark, N. J.
Metals Coating Co. of America, 495 N. Third, Philadelphia, Pa.
Metals Protection Corp., 401 Michigan, Indianapolis, Ind.
Parker Rust-Proof Co., 2177 E. Milwaukee, Detroit, Mich.
Rochester Elec. Products Corp., 89 Allen, Rochester, N. Y.
United Chromium, Inc., 51 E. 42d, New York, N. Y.
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U. S. Chromium Corp., Wilkinsburg Sta., Pittsburgh, Pa.

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Baker & Co., Inc., 54 Austin, Newark, N. J.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Wilco. See H. A. Wilson Co.
Wildberg Bros., Smelting & Refining Co., 742 Market, San Francisco, Cal.
Wilson Co., H. A., Newark, N. J.

PLUG FUSES. See Fuses and Fuse Wire.
PLUG RECEPTACLES. See Receptacles, Plug.
PLUGS, Flashing. See Flashers, Sign.
PLUGS, Radio. See Radio Receiver Parts.

PLUGS, Attachment

A-1 Bakelite. See Connecticut Elec. Mfg. Co.
Ajax Elec. Specialty Co., 1928 Chestnut, St. Louis, Mo.
Alcor Mfg. Co., 4606 W. Madison, Chicago.
Anselite Elec. Mfg. Co., New Haven, Conn.
Anylite Elec. Co., Fort Wayne, Ind.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Arro-Grip. See Arrow Elec.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beaver Mfg. Co., 635 N. Third, Newark, N. J.
Bee-Ell Elec. Mfg. Co., 79 Mercer, New York, N. Y.
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Cemco. See Connecticut Elec. Mfg. Co.
Cetelite. See Connecticut Moulded Products.
Circle F Mfg. Co., Trenton, N. J.
Colts Patent Fire Arms Mfg. Co., Hartford, Conn.
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Connecticut Moulded Products Corp., Meriden, Conn.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Dual Electric Co., 453 Broome, New York, N. Y.
Diamond, H. See Hart Mfg. Co.
Dreadnaught. See Cutler-Hammer Mfg. Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Eastman Mfg. Co., Manitowoc, Wis.
Electric Co., 94 Allyn, Hartford, Conn.
Ericson Mfg. Co., 3357 Bradford Rd., Cleveland, O.
Esler Elec. Mfg. Co., 802 S. Adams, Marion, Ind.
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Fitzall. See Rodale Mfg. Co.
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Gold Seal Elecl. Co. of Ohio, Inc., 250 Park Ave., New
Gripall. See Beaver Mfg. Co.
Handle Cap. See Beaver Mfg. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Heetach. See Marks Products Co.
Hemco. See Bryant Electric Co.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
H. & H. See Hart & Hegeman.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Iona Co., 416 W. Eighth, Los Angeles, Cal.
Jiffy. See Esler Elec. Mfg. Co.
Kool Plug. See Colt's Patent Fire Arms Mfg. Co.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Marks Products Co., 23 E. 16th, New York.
Metropolitan Electric Mfg. Co., Blvd. at 14th St., Long Island City, N. Y.
Nelco. See Nelson Elec. Co.
Nelson Elec. Co., Plant City, Fla.
P. & S. See Pass & Seymour.
Paragon Elec. Sales Co., 215 S. Fifth, Philadelphia, Pa.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Quartap. See Connecticut Elec. Mfg. Co.
Poloron Elec. Mfg. Co., 20 Bond, New York, N. Y.
Propp Co., M., 524 Broadway, New York.
Quick Catch. See Hubbell, Inc., Harvey.
Real. See Smith & Co., T. C.
Real Diamond. See Smith & Co., T. C.
Reben Electric Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Reynolds Spring Co., Jackson, Mich.
Reynolite Masterpiece. See Reynolds Spring Co.
Ripple. See Bryant Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York.
Safegard Elec. Appliance Co., 133 S. Twelfth, Philadelphia.
Samson Cutlery Co., 8 Jones, Rochester, N. Y.
Sears, Henry D., 80 Boylston, Boston 11, Mass.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Snapit. See Marks Products Co.
Snoco. See Snow & Co., E. W.
Snow & Co., E. W., Rochester, N. Y.
Spartanette. See Bryant Elec. Co.
Spar Tap. See Bryant Elec. Co.
Speedway Elec. Mfg. Co., 30 Church, New York, N. Y.
Standard. See Cutler-Hammer Mfg. Co.
Suitsall. See Beaver Mfg. Co.
Surefit. See Alcor Mfg. Co.
T. E. C. See Electric Co.
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Templus. See Bryant Elec. Co.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trio-Tap. See Rodale Mfg. Co.
Triple Tap. See General Elec. Co.
Twin Tap. See General Elec. Co.
United States Elec. Mfg. Co., 222 W. 14th, New York.
Un-X-Ld. See Speedway Elec'l Mfg. Co.
Utilo Mfg. Co., 320 E. Liberty, Lancaster, Pa.
Weber. See Sears, Henry D.
Wellmade Elec. Mfg. Co., Torrington, Conn.
Wilshires. See Iona Co.
Yankee. See Beaver Mfg. Co.

POCKET METERS. See Instruments, Pocket.

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Baker & Co., Inc., 54 Austin, Newark, N. J. (Gold, Platinum, Silver.)
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J. (Platinum and Silver.)
Cohn, Sigmund, 44 Gold, New York, N. Y. (Platinum.)
Elkon, Inc. (Div. of P. R. Mallory Co.), 350 Madison Ave., New York, N. Y.
Fansteel Products Co., North Chicago, Ill.
Hardy Metal Corp., Seattle, Wash.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Independent Contact Mfg. Co., 545 39th, Union City, N. J. (Tungsten.)
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Molding Machine. See Presses, Porcelain Molding.
Reflectors (Enameled). See Reflectors, Porcelain Enameled.
Refractory. See Cores, Resistance Coil.

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A. P. See Akron Porcelain Co.
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Central Porcelain Co., Columbiana, O.
Circle F Mfg. Co., Trenton, N. J.
Colonial Insulator Co., Akron, O.
Connecticut Porcelain Co., Trenton, N. J.
Cook Pottery Co., Trenton, N. J.
Corna China Co., Wellsville, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Globe Porcelain Co., Mulberry St. and St. Joes Ave., Trenton, N. J.
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Porcelava. See Burgess & Co.
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Square D Company, Detroit, Mich.
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Star Porcelain Co., Muirhead St., Trenton, N. J
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.
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Robinson Clay Products Co., Akron, Ohio.

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Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
DeJur-Amsco Corp., 418 Broome, New York, N. Y.
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Ensign. See Eby Mfg. Co., H. H.
Eureka. See Frank W. Morse Co.
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King. See Morse Co., Frank W.
Morse Co., Frank W., 289 Congress, Boston. (Spring Grip
Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
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Premier Elec. Co., 1802 Grace, Chicago, Ill.
Quality. See H. H. Eby Mfg. Co.
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POWDERED CARBON. See Carbon, Powdered.
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PRESS BOARD. See Cloth and Paper.

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Comstock Mfg. Co., Wilkes-Barre, Pa.
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Dunning & Boschert Press Co., 329 W. Water, Syracuse
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Evans Engrg. Works, Chas. E., 1002 Fulton, Chicago, Ill
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Stokes Mach. Co., F. J., 5834 Tabor Rd. (Olney), Philadelphia, Pa.
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Rockford Iron Works, 846 Ray, Rockford, Ill.
PRISMS, Chandelier. See Crystals, Chandelier
PROJECTOR LENSES. See Lenses.

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Peerless. See Electric Service Supplies Co.
Premier Electric Co., 1802 Grace, Chicago, Ill.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill

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Milwaukee Tank Wks., Milwaukee, Wis.
Monroe Machine Tool Co., 737 W. Jackson Blvd., Chicago
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Simplex Oil Heating Co., 1199 Eddy, Providence, R. I.
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Eimer & Amend, 205 3rd Ave., New York, N. Y.
Eisler Elec. Corp., 756 S. 13th, Newark, N. J.
General Electric Co., Schenectady, N. Y.
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Amperite Rheostat. See Radiall Co.
Arco Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Arctic. See Premier Elec. Co.
Art Dial. See Pilot Radio & Tube Corp.
Audioformer Transformer. See Pacent Electric Co.
Autoformer. See Thordarson Elec. Mfg. Co.
Automatic Oil Heat Co., 9294 E. Fourth, St. Paul, Minn.
Automotive Parts Mfg. Co., 70 Washington St., Brooklyn.
B-Conomizer. See Pilot Radio & Tube Corp.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Bonine. See Turn-it Radio Sales.
Branston Co., Chas. A., 297 Washington, Buffalo, N. Y.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y.
Browning-Drake Corp., Calvary, Waltham, Mass.
Buffer. See Aerovox Wireless Corp.
Buffalo. See De Jur-Amsco Corp.
Camfield. See Columbia Metal Products Co.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Capacigrad. See Pilot Radio & Tube Corp.
Cardwell Mfg. Corp., Allen D., 81 Prospect, Brooklyn, N. Y.
Carter Mfg. Co., 6300 Euclid Blvd., East Cleveland, O.
Carter Radio Co., 407 S. Aberdeen, Chicago, Ill.
Central Radio Corp., Beloit, Wis.
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Chelten Elec. Co., 4859 Stenton Ave., Philadelphia, Pa.
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Continental. See Gardiner & Hepburn, Inc.
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Cresradio Corp., 166-32 Jamaica Ave., Jamaica, N. Y.
Crefot. See Premier Elec. Co.
Daven Corp., 158 Summit, Newark, N. J. (Kits)
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De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Diamond Weave Coil. See Sickles Co., F. W.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Dubilier Condenser Corp., 342 Madison av., New York.
Dumont Elec. Co., 40 W. 17th, New York, N. Y.
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Dymac. See Electrical Products Mfg. Co.
Dynohmic. See Lynch, Inc.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I. (Kit.)
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill.
Electro Motive Engineering Corp., 127 W. 17th, New York
Elkay. See Langbein Kaufman Radio Co.
Elkon, Inc., 350 Madison Ave., New York, N. Y.
El Menco. See Electro Motive Engineering Co.
Equamatic Kit. See Karas Elec. Co.
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Filterettes. See Tobe Deutschmann Co.
Filtrola. See All-American Mohawk Corp.
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Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
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F. & H. Radio Laboratories, Fargo, N. D.
Gardiner & Hepburn, Inc., 611 Widener Bldg., Philadelphia, Pa.
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General Winding Co., 214 Fulton, New York, N. Y.
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Globar Corp., Niagara Falls, N. Y.
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International Resistance Co., 2006 Chestnut, Philadelphia, Pa.
Isograd Isolene. See Pilot Radio & Tube Corp.
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Lynch, Arthur H., 1775 Broadway, New York, N. Y.
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Mountford, C. E., 36 Sullivan, New York, N. Y.
Muter Co., Leslie F., 8440 S. Chicago Ave., Chicago, Ill. (Amplifier Kits.)
National Co., 61 Sherman St., Malden, Mass
Neutro-Grad. See Pilot Radio & Tube Corp.
New York Coil Co., Mount Clare, Pa.
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Ohio Carbon Co., 8215 Almira Ave., Cleveland, O.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill. (Resistance.)
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Pacent Electric Co., 91 7th Ave., New York, N. Y.
Pam. See Samson Elec. Co.
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Perry Elec'l Resistor Corp., 280 New Main St., Yonkers, N. Y.
Phasatrol. See Electrad, Inc.
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PORCELAIN
Bushings. See Bushings, Box & Cabinet.
Liquid. See Cement, Liquid Porcelain.
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Refractory. See Cores, Resistance Coil.

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American Porcelain Co., E. Liverpool, O.
A. P. See Akron Porcelain Co.
Burgess & Co., East Liverpool, O.
Central Porcelain Co., Columbiana, O.
Circle F Mfg. Co., Trenton, N. J.
Colonial Insulator Co., Akron, O.
Connecticut Porcelain Co., Trenton, N. J.
Cook Pottery Co., Trenton, N. J.
Corns China Co., Wellsville, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Globe Porcelain Co., Mulberry St. and St. Joes Ave., Trenton, N. J.
Hartford Faience Co., Hartford, Conn.
Hub-Way Mfg. Co., Hubbard, Ohio.
Illinois Electric Porcelain Co., Macomb Ill.
Imperial Porcelain Wks., Canal and Mulberry, Trenton, N. J.
Knox Porcelain Corp., Knoxville, Tenn.
Louthan Mfg. Co., East Liverpool, O.
Mercer Porcelain Co., Trenton, N. J.
Metsch Refractories Co., East Liverpool, Ohio.
National Porcelain Co., Trenton, N. J.
New Jersey Porcelain Co., Trenton, N. J.
Nu Blac. See Star Porcelain Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y
Porcelava. See Burgess & Co.
Porcelain Products, Inc., Findlay, Ohio.
Square D Company, Detroit, Mich.
Standard & Specialty Porcelain Co., Sun Prairie, Wis
Star Porcelain Co., Mudrhead St., Trenton, N. J
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.
Thomas & Sons Co., R., Lisbon, O.
Trenle Porcelain Co., East Liverpool, Ohio.
Union Elec'l Porcelain Wks., Inc., Trenton, N. J.
Washington Porcelain Co., Washington, N. J.

POROUS CUPS
Unglazed earthenware cups for primary (wet) batteries
Colonial Insulator Co., Akron, Ohio.
Maddocks Sons, John, Trenton, N. J.
Ohio Pottery Co., Zanesville, Ohio.
Robinson Clay Products Co., Akron, Ohio.

POSTS, Binding
Binding Posts, Switch Parts, Stop Points, Contacts Arms, Levers. See also Radio Mountings.
American Radio Hardware Co., 135 Grand, New York
Bunnell & Co., J. H., 32 Park Pl., New York, N. Y
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
DeJur-Amsco Corp., 418 Broome, New York, N. Y.
Eby Mfg. Co., Inc., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Ensign. See Eby Mfg. Co., H. H.
Eureka. See Frank W. Morse Co.
Grammes & Sons, Inc., L. F., Allentown, Pa
Gray Bros., Plano, Ill.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
King. See Morse Co., Frank W.
Morse Co., Frank W., 289 Congress, Boston. (Spring Grip
Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Polk, J. L., 41 Bell Ave., Troy, N. Y.
Premier Elec. Co., 1502 Grace, Chicago, Ill.
Quality. See H. H. Eby Mfg. Co.
Queen. See Morse Co., Frank W.
Thomaston Mfg. Co., Thomaston, Conn
Waterbury Button & Moulding Co., Waterbury, Conn.
POTENTIOMETERS (Instruments). See Instruments, Laboratory Standard.
POTENTIOMETERS (Radio Control). See Radio Receiver Parts.
POWDERED CARBON. See Carbon, Powdered.
POWER TRANSMISSION CHAIN. See Chain, Power Transmission
PRESS BOARD. See Cloth and Paper.

PRESSES, Armature Coil
Comstock Mfg. Co., Wilkes-Barre, Pa.
PRESSES, ARMATURE NOTCHING. See Notching Machines, Armature.

PRESSES, Molded Insulation
Burroughs Co., 246 N. Tenth, Newark, N. J.
Dunning & Boschert Press Co., 329 W. Water, Syracuse
Elmes Engrg. Works, Chas. F., 230 N. Morgan, Chicago
Evans Engrg. Works, Chas. E., 1002 Fulton, Chicago, Ill
Farquhar Co., A. B., York, Pa.
French Oil Mill Machinery Co., Piqua, O.
Southwark Fdy. & Mach. Co., 400 Washington Ave., Philadelphia, Pa.
Stokes Mach. Co., F. J., 5534 Tabor Rd. (Olney), Philadelphia, Pa.
Terkelson Machine Co., 326 A, Boston, Mass.
Watson-Stillman Co., 75 West St., New York, N. Y
Wood & Co., R. D., Florence, N. J.

PRESSES, Porcelain Molding
Baird, Andrew, 2715 Newark, Detroit, Mich

PRESSES, Punching and Bending
Bench Presses—Power Presses; for Punching & Stamping Sheet Metal.
Ams Machine Co., Max, 101 Park Ave., New York, N. Y
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., 53rd St. & Second Ave., Brooklyn, N. Y
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hyro Mfg. Co., 200 Varick, New York, N. Y.
Loehbough-Jordan Tool & Machine Co., Elkhart, Ind
Niagara Machine & Tool Wks., 637 Northland, Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
PRESSES, Stamping. See Presses, Punching & Bending.
Rockford Iron Works, 846 Ray, Rockford, Ill.
PRISMS. Chandelier. See Crystals, Chandelier
PROJECTOR LENSES. See Lenses.

PULLERS, Armature Shaft
Motor Pulley, Shaft & Pinion Pullers & Extractors
Allen Electric & Equipment Co., Kalamazoo, Mich
Big Buster. See Premier Elec. Co.
Crane Puller Co., Waltham, Mass.

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Duff Mfg. Company, Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts Philadelphia, Pa.
Little Giant. See Premier Elec. Co.
Peerless. See Electric Service Supplies Co.
Premier Electric Co., 1802 Grace, Chicago, Ill.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill

PULLEYS, Composition
General Electric Co., Schenectady, N. Y.
Rockwood Mfg. Co., Indianapolis, Ind.
Sprucolite Co., Bloomfield, N. J.

PUMPS, Oil Burner
Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Milwaukee Tank Wks., Milwaukee, Wis.
Monroe Machine Tool Co., 737 W. Jackson Blvd., Chicago
Reflex. See Simplex Oil Heating Co.
Simplex Oil Heating Co., 1199 Eddy, Providence, R. I.
Teesdale Mfg. Co., 427 Market, Grand Rapids, Mich.

PUMPS, Vacuum
To Exhaust Incandescent Lamps.
Beach-Russ Co., 50 Church, New York, N. Y.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Dunham Co., C. A., 450 East Ohio, Chicago, Ill.
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Eisler Elec. Corp., 756 S. 13th, Newark, N. J.
General Electric Co., Schenectady, N. Y.
Hubbard's Sons, Norman, 1 Carlton Ave., Brooklyn, N. Y.
Leiman Bros., 22 Walker, New York, N. Y.
Packard. See Hubbard's Sons, Norman.
PUNCHING PRESSES. See Presses, Punching.

PUNCHING and BENDING, Sheet Steel
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.

RACKS, Wire Reel
(With Tension Device Attached).
Armature Coil Equipment Co., 2415 Furnesdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Elec'l Wks., P. E., 1826 Chouteau Ave., St. Louis, Mo. (Tensionless Dereeler)
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Elec. Co., Schenectady, N. Y. (Tension Indicator.)
Mutual Foundry & Machine Co., Atlanta, Georgia.
Segur. See Electric Service Supplies Co.

RADIO CIRCUIT COMPONENTS
This heading includes Inductances (Coils), Capacitors (Condensers), Fixed Resistances, Grid Leaks, Transformers, Choke Coils, and Filters, also Amplifier Units and Kits.
Acme Appar. Corp., 39 Osborne, Cambridge, Mass.
Acme Products Co., Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero-Call. See Aero Products, Inc.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Aero Products, Inc., 4611 Ravenswood Ave., Chicago, Ill.
Air-King Products Co., 216 Wallabout, Brooklyn, N. Y.
Ajax Elec. Specialty Co., St. Louis, Mo.
Alden Mfg. Co., Springfield, Mass.
All-American Mohawk Corp., 4201 Belmont Ave., Chicago.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Amerchoke. See American Transformer Co.
American Apparatus Co., Richmond, Ind.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
American Transformer Co., Newark, N. J
Amperite Rheostat. See Radiall Co.
Arco Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Arctic. See Premier Elec. Co.
Art Dial. See Pilot Radio & Tube Corp.
Audioformer Transformer. See Pacent Electric Co.
Autoformer. See Thordarson Elec. Mfg. Co.
Automatic Oil Heat Co., 9294 E. Fourth, St. Paul, Minn.
Automotive Parts Mfg. Co., 70 Washington St., Brooklyn.
B-Conomizer. See Pilot Radio & Tube Corp.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Bonine. See Turn-it Radio Sales.
Branston Co., Chas. A., 297 Washington, Buffalo, N. Y.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y.
Browning-Drake Corp., Calvary, Waltham, Mass.
Buffer. See Aerovox Wireless Corp.
Buffalo. See De Jur-Amsco Corp.
Camfield. See Columbia Metal Products Co.
Campbell Electric Mfg. Co. 15 Stewart, Lynn, Mass.
Capacigrad. See Pilot Radio & Tube Corp.
Cardwell Mfg. Corp., Allen D., 81 Prospect, Brooklyn, N. Y.
Carter Mfg. Co., 6300 Euclid Blvd., East Cleveland, O.
Carter Radio Co., 407 S. Aberdeen, Chicago, Ill.
Central Radio Corp., Beloit, Wis.
Centraline. See Pilot Radio & Tube Corp.
Certified Condenser. See Radio Condenser Co.
Chelten Elec. Co., 4859 Stenton Ave., Philadelphia, Pa.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago
Clarostat Mfg. Co., 281 N. Sixth, Brooklyn, N. Y. (Radio Resistance.)
Cole Radio Mfg. Corp., 536 Bloomfield Ave., Bloomfield, N. J

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Columbia Metal Products Co., 360 E. Grand Ave., Chicago.
Concertone. See Chicago-Jefferson Fuse.
Connectoralds. See Alden Mfg. Co.
Continental Carbon, Inc., Cleveland, O.
Continental. See Gardiner & Hepburn, Inc.
Cornell Elec. & Mfg. Co., Anable & Rawson, Long Island City, N. Y.
Cresradio Corp., 166-32 Jamaica Ave., Jamaica, N. Y.
Crefot. See Premier Elec. Co.
Daven Corp., 158 Summit, Newark, N. J. (Kits)
DeForest Radio Co., Jersey City, N. J.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Diamond Weave Coil. See Sickles Co., F. W.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Dubilier Condenser Corp., 342 Madison av., New York
Dumont Elec. Co., 40 W. 17th, New York, N. Y.
Duratran. See Dubilier Condenser Corp.
Durham & Co., 1936 Market, Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Dynohmic. See Lynch, Inc.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I. (Kit.)
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill.
Electro Motive Engineering Corp., 127 W. 17th, New York
Elkay. See Langbein Kaufman Radio Co.
Elkon, Inc., 350 Madison Ave., New York, N. Y.
El Menco. See Electro Motive Engineering Co.
Equamatic Kit. See Karas Elec. Co.
Equitrol. See Cardwell Mfg. Corp.
E-Z. See Polymet Mfg. Corp.
Faradon. See Wireless Specialty Apparatus Co.
Faut Co., John E., 3982 Barry Ave., Chicago, Ill.
Ferranti, Inc., 130 W. 42nd, New York, N. Y.
Filatrol. See De Jur-Amsco Corp,
Filterettes. See Tobe Deutschmann Co.
Filtrola. See All-American Mohawk Corp.
Flechtheim Co., A. M., 136 Liberty, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind.
F. & H. Radio Laboratories, Fargo, N. D.
Gardiner & Hepburn, Inc., 611 Widener Bldg., Philadelphia, Pa.
General Instrument Corp., 225 Varick, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
General Transformer Corp., 910 W. Jackson Blvd., Chicago
General Winding Co., 214 Fulton, New York, N. Y.
Gen-Win. See General Winding Co.
Ger-Alt Radio Laboratories, 859 Flatbush Ave., Brooklyn, N. Y. (Adapter.)
Glastor. See Daven Corp.
Globar Corp., Niagara Falls, N. Y.
Glo-Dial. See Wireless Radio Corp.
Gray & Danielson Mfg. Co., 260 1st, San Francisco, Cal.
Halldorsen Co., 4745 N. Western Ave., Chicago, Ill.
Hamilton-Sangamo Corp.
Hammarlund Mfg. Co., 424 W. 33rd, New York, N. Y.
Hardwick, Hindle, Inc., 122 Greenwich, New York, N. Y.
Harmonik. See Karas Elec. Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. (TRF Kits.)
Hedgehog Transformer. See Premier Elec. Co.
Heinemann Elec. Co., Trenton, N. J.
Held-Tite, Hi-ohm, Hi-pot. See Carter Radio Co.
Hi-Q Kit. See Hammarlund.
Hum-Dinger. See Clarostat Mfg. Co.
Hy-Wat. See Electro Motive Engineering Corp.
Igrad Condenser & Mfg. Co., 4322 Lake Ave., Rochester, N. Y.
Infra-Dyne. See Gray & Danielson Co.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa.
Isograd, Isoleak. See Pilot Radio & Tube Corp.
J-M-P. Mfg. Co., 3329 Fond du Lac Ave., Milwaukee, Wis.
Karas Elec. Co., 4040 N. Rockwell, Chicago, Ill.
Kelford. See American Specialty Co.
Kenyon Transformer Co., 122 Cypress Ave., New York, N. Y.
Kilograd. See Pilot Radio & Tube Corp.
Krobiack. See Mountford, C. E.
Kuprox. See Kodel Radio Corp.
Langbein-Kaufman Radio Co., 62 Franklin, New Haven, Conn.
Lavite. See Aerovox Wireless Corp.
Lautz Mfg. Co., 245 N. J. R. R. Ave., Newark, N. J. (Radio Resistance).
Lekeless. See Benjamin Elec. Mfg. Co.
Lemnis. See General Winding Co.
L. M. C. See Lautz Mfg. Co.
Loftin-White. See Hammarlund Mfg. Co.
Loiess. See Wireless Radio Corp.
Lynch, Arthur H., 1775 Broadway, New York, N. Y.
Marco. See Martin-Copeland Co.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Maxitran. See Electrical Research Laboratories.
Mayolian Corp., 1568 Webster Ave., New York, N. Y. (Tone Filter.)
Meggit. See Cole Mfg. Corp.
Melco-Supreme. See De Jur-Amsco Corp.
Melcoupler. See Robertson-Davis Co.
Meloformer. See Robertson-Davis Co.
Metaleak. See Dubilier Condenser Corp.
Metraligm. See General Instrument Corp.
Micalon Condenser. See Dubilier Condenser Corp.
Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y (Amplifier Kit.)
Mica-Static. See Dubilier Condenser Corp.
Micon Condenser. See Dubilier Condenser Corp.
Microcondenser. See Sterling Mfg. Co
Microgrid. See Pilot Radio & Tube Corp.
Micrometric. See Karas Elec. Co.
Microstat. See Premier Elec. Co.
Midline. See Hammarlund Mfg. Co.
Modern Electric Mfg. Co., Toledo, O.
Mountford, C. E., 30 Sullivan, New York, N. Y.
Muter Co., Leslie F., 3440 S. Chicago Ave., Chicago, Ill. (Amplifier Kits.)
National Co., 61 Sherman St., Malden, Mass
Neutro-Grad. See Pilot Radio & Tube Corp.
New York Coil Co., Mount Clare, Pa.
Nutmeg. See Hart & Hegeman Mfg. Co.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, O.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill. (Resistance.)
One Way. See Carter Radio Co.
Orthometric. See Karas Elec. Co.
Orthophone. See De Jur-Amsco Corp.
Pacent Electric Co., 91 7th Ave., New York, N. Y.
Pam. See Samson Elec. Co.
Panatrol. See Wireless Radio Corp.
Perry Elec'l Resistor Corp., 280 New Main St., Yonkers, N. Y.
Phasatrol. See Electrad, Inc.
Philmore Mfg. Co., 106 7th Ave., New York, N. Y.
Piander. See De Jur-Amsco Corp.
Pierce Airo. See United Scientific Laboratories
Pilot Radio & Tube Corp., 323 Berry, Brooklyn, N. Y.
Pilotran. See Pilot Radio & Tube Corp.
Potter Mfg. Co., North Chicago, Ill.
Polymet Mfg. Corp., 829 E. 134th St., New York, N. Y.
Power Box. See Scott Sales Co.
Powerohm. See International Resistance Co.
Powrad, Inc., 121 Ingraham, Brooklyn, N. Y.
Precision Coil Co., 122 Greenwich, New York, N. Y.
Precise Mfg. Corp., 254 Mill, Rochester, N. Y.

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Protectorald. See Alden Mfg. Co.
Pyrohm. See Aerovox Wireless Corp.
Radiall Co., 50 Franklin, New York, N. Y.
Radio Appliance Corp., Springfield, Mass.
Radio Condenser Co., Thorn & Copewood, Camden, N. J.
Radio Engrg. Laboratories, 100 Wilbur Ave., Long Island City, N. Y. (Short Wave Kit.)
Radiolce Switch. See Cutler-Hammer Mfg. Co.
Radio Receptor Co., 106 7th Ave., New York.
Radiostat. See Allen-Bradley Co.
Raola. See Modern Elec. Mfg. Co.
Rauland-Lyric. See All American Mohawk Corp.
Receptrad. See Radio Receptor Co.
Resonator. See F. & H. Radio Laboratories.
Regal. See American Specialty Mfg. Co.
Reliable Parts Mfg. Co., Wellington, O.
Remler. See Gray & Danielson Co.
Resistaformer. See Aerovox Wireless Corp.
Resistograd. See Pilot Radio & Tube Corp.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent); Hathway & Co., 16 Hudson, New York, N. Y.
Roberts Condenser. See Hammarlund Mfg. Co.
Robertson-Davis Co., 412 Orleans, Chicago, Ill.
Samson Elec. Co., Canton, Mass. (TRF Kits.)
Scovill Mfg. Co., Waterbury, Conn.
Senior. See All American Mohawk Corp.
Sensory. See Heinemann Electric Co.
Sevison Magneto Engr. Co., 397 Phillips, Toledo, O.
Shallcross Mfg. Co., 700 Parker Ave., Collingdale, Pa.
Sickles Co., F. W., 130 Union, Springfield, Mass.
Signal Elec. Mfg. Co., Menominee, Mich.
Silver-Marshall, Inc., 6401 W. 65th St., Chicago. (Amplifier Kits.)
Silvertone. See Radio Receptor Co.
S. L. S. See Wireless Radio Corp.
S. L. T. See General Instrument Corp.
Somersolo. See DeForest Radio Co.
Splitmeter. See Premier Electric Co.
Sprague Specialties Co., Dept. M., Quincy, Mass.
Standard Transformer Co., Warren, O.
Sta-Put. See Martin-Copeland Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, O.
Stromberg-Carlson Tel. Mfg. Co., 1466 University Ave., Rochester, N. Y.
Submariner. See J-M-P Mfg. Co.
Super Multiformer. See Precise Mfg. Corp.
Supertran Transformer. See Ford Radio & Mica Co.
Symphony. See Modern Elec. Mfg. Co.
Syncrodenser. See Precise Mfg. Corp.
Telemonic Coil. See Condenser Corp. of America.
Teloa Coil. See Condenser Corp. of America.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago
Tobe Deutschman Co., Canton, Mass.
Tone Control. See Sprague Specialties Co.
Toroid. See All American Mohawk Corp.
Transcript-Clapp Kit. See Samson Electric Co.
Truphonic Amplification. See Alden Mfg. Co.
Tunadapta. See Lynch, Arthur H.
Tuway. See Carter Radio Co.
Twin-aud. See Psurless Radio Co.
Twin-Eight Transformers. See Bodine Electric Co.
Two-Ten & Two-Eleven. See Silver-Marshall.
Tyrman Elec. Corp., 314 W. Superior, Chicago, Ill.
Ultra Vario. See Bruno Radio Corp.
Universier Condenser. See Auburn Button Works.
Universal Electro Chemical Corp., 30 W. 15th, New York.
Universal Winding Co., Boston, Mass.
Valley Appliances, Inc., 634 Lexington Ave., Rochester, N. Y.
Variall Condenser. See Muter Co.
Volta. See Universal Electro Chemical Corp.
Volumgrad. See Pilot Radio & Tube Corp.
Walbert Radio Corp., 1000 Fullerton Ave., Chicago, Ill.
Waterbury Button & Moulding Co., Waterbury, Conn.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn, N. Y.
Wireless Specialty Apparatus Co. (J. P.), Boston, Mass.

RADIO HARDWARE. See Radio Mountings.

RADIO MOUNTINGS

Coil Mountings, Coil Sliders and Rods, Switches, Detectors, Detector and Grid Leak Mountings, Panel Brackets, Special Radio Hardware & Trimmings, Metal Dials, Metal Panels, etc.

Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Alden Mfg. Co., Brockton, Mass.
American Emblem Co., Utica, N. Y.
American Radio Hardware Co., 185 Grand, New York.
Bonza. See Haydon & Haydon.
Carborundum Co., Niagara Falls, N. Y. (Detector.)
Chapman Machine Co., Terryville, Conn.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Durham & Co., 1936 Market, Philadelphia, Pa.
Electrad, Inc., 175 Varick, New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y. (Metal Panels.)
Eureka. See Morse Co Frank W.
General Etching & Mfg. Co., 3072 West Grand Ave., Chicago, Ill. (Metal Panels & Escutcheons.)
Globe Technolian Corp., Reading, Mass.
Glodial. See Wireless Radio Corp.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Haydon & Haydon, 167 Chambers, New York, N. Y.
Master Engineering Co., 122 S. Michigan Ave., Chicago, Ill.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 8440 S. Chicago Ave., Chicago.
Na-Ald. See Alden Mfg. Co.
Union Insulating Co., 296 Broadway, New York, N. Y.
Waddell Mfg. Co., Grand Rapids, Mich.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO PANEL ENGRAVING. See Engraving, Radio Panel.

RADIO RECEIVER PARTS

Rheostats, Sockets, Plugs, Jacks.
Amne Elec. & Mfg. Co., 1652 Rockwell, Cleveland, Ohio.
Alden Mfg. Co., Springfield, Mass.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Amacostat. See American Apparatus Co.
American Apparatus Co., Richmond, Ind.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Automotive Equipment Co., 317 Halsey, Newark, N. J.
B. M. S. See Brooklyn Metal Stamping Corp.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. (Multiple Plugs.)
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Brach Mfg. Corp., L. S., 120 Sussex Ave., Newark, N. J.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn.
Cabelug. See Jones, Howard B.
Carter Radio Co., 407 S. Aberdeen, Chicago, Ill. (Also Socket Adapters.)
Central Radio Laboratories, 14 Keals Ave., Milwaukee.
Centralab. See Central Radio Laboratories.
Clarostat Mfg. Co., 285 N. Sixth, Brooklyn, N. Y.
Cle-Ra-Tone. See Benjamin Elec. Mfg. Co.
D. A. Radio Co., 30 Hollister, Buffalo, N. Y.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.

De Vau. See Stanley & Patterson.
Dongan Elec. Mfg. Co., 2966 Franklin, Detroit, Mich.
Duostat. See De Jur-Amsco Corp.
E-Z. See Polymet Mfg. Corp.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Electrad, Inc., 175 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I.
Fantail Plug. See Brooklyn Metal Stamping Corp.
Frost, Herbert H., 1142 W. Beardsley, Elkhart, Ind.
Gem-Jac. See Frost, Herbert H.
General Instrument Corp., 225 Varick, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
Gray & Danielson Mfg. Co., 260 First, San Francisco, Cal.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Heinemann Elec. Co., Trenton, N. J.
Imp. See Carter Radio Co.
Jones, Howard B., 2300 Wabansia, Chicago. (Multiple Plug)
Kleaner Radio Corp., 1022 E. 178th, New York, N. Y.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Micrograd. See Pilot Radio & Tube Corp.
Modu-Plug. See Central Radio Lab.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 8440 S. Chicago Ave., Chicago.
Nutmeg. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Pacent Elec. Co., 91 Seventh Ave., New York, N. Y.
Pan-Tab Jack. See Frost, Herbert H.
Philmore Mfg. Co., 106 Seventh Ave., New York, N. Y.
Pilot Radio & Tube Corp., 323 Berry, Brooklyn, N. Y.
Polymet Mfg. Corp., 829 E. 134th St., New York, N. Y.
Premier Elec. Co., 1802 Grace, Chicago, Ill.
Recto Mfg. Co., 23 W. Third, Cincinnati, Ohio
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Royalty. See Electrad, Inc.
Samson Elec. Co., Canton, Mass.
Socostat. See D. A. Radio Co.
Stanley & Patterson, 150 Varick, New York, N. Y.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Tubestat. See Muter Co.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO RECTIFIER TUBES

Armstrong Electric Co., 187 Sylvan Ave., Newark, N. J.
Arcturus Radio Tube Co., 260 Sherman Ave., Newark, N. J
Cable Radio Tube Corp., 80 N. Ninth, Brooklyn, N. Y.
Ceco Mfg. Co., 1200 Eddy, Providence, R. I.
Conneway Elec. Laboratories, 406 Jefferson, Hoboken, N. J
Cunningham, Inc., E. T., 370 Seventh Ave., New York, N. Y
DeForest Radio Co., Franklin St. & Central Ave., Jersey City, N. J.
Diamond Electric Co., Newark, N. J.
Diamond Vacuum Products Co., 4053 Diversey Ave., Chicago
Eveready Raytheon. See National Carbon Co.
Gold Seal Electrical Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
Hygrade Lamp Co., Salem, Mass.
Jaeger Research Laboratories, 280 Park Ave., Weehawken, N. J.
Ken-Rad Tube & Lamp Corp., Owensboro, Ky.
La Salle Radio Corp., Div. of Matchless Elec. Co., 1500 N. Ogden Ave., Chicago, Ill.
Manhattan Elecl. Supply Co., 510 Sixth Ave., New York.
National Carbon Co., New York, N. Y.
Neptron. See Hygrade Lamp Co.
Northern Mfg. Co., 367 Ogden, Newark, N. J.
Paramount Mfg. Co., 79 Orange, Newark, N. J.
Perryman Electric Co., 4901 Hudson Blvd., North Bergen, N. J.
Radio-Victor Corp. of America, 233 Broadway, New York.
Sonatron Tube Co., 1020 S. Central Park Ave., Chicago, Ill.
Specialty Appliance Co., 6611 Euclid Ave., Cleveland, Ohio.
Sylvania Products Co., Emporium, Pa.
Televocal Corp., 582 Twelfth, West New York, N. J.
United Radio & Elec. Corp., 500 Chancellor Ave., Irvington N. J.

RADIO TRANSFORMERS. See Radio Circuit Components
RADIO TUBE BASE BRANDERS. See Engraving Radio Panel.
RADIO TUBE BASES. See Radio Molded Parts.
RADIO TUBE BULBS (Unfinished). See Bulbs, Glass.

RADIO TUBE PARTS

Filament Hooks, Screens, Bolts & Nuts & Special Stampings.
Juno Fasteners, Inc., Hillside, N. J.

RADIO WIRING HARNESS

Special wiring cable and harness assemblies for radio battery connections, radio tube adapter harness for converting battery operated receivers to A.C. operation; Socket Adapters for Power Tubes; Loud Speaker Extension Cords—This heading also includes auto ignition assemblies.

Afco. See American Fabric Co.
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo.
Alden Mfg. Co., Brockton, Mass. (Adapters.)
Alpbus. See Alpha Radio Supply Co.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Alpstrand. See Alpha Radio Supply Co.
American Braiding Co., Holyoke, Mass.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Birnbach Radio Co., 254 W. 31st St., New York, N. Y.
Blue Ribbon. See Crescent Braid Co.
Brach Mfg. Co., L. S., Newark, N. J.
Connectoralds. See Alden Mfg. Co.
Cornish Wire Co., 30 Church, New York, N. Y.
Corwico. See Cornish Wire Co.
Crescent Braid Co., Providence, R. I.
Crescent Insulated Wire & Cable Co., Trenton, N. J.
De Luxe, 50 W. Houston, New York, N. Y.
Diamond Braiding Mills, Chicago Heights, Ill.
Echo. See Cornish Wire Co.
Enterprise Mfg. Co., Third & Dauphin Sts., Philadelphia, Pa. (Adapters).
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind. (Adapters.)
Hatfield Rubber Wks., Inc., Hillside, N. J.
Lusterised. See American Braiding Co.
Manhattan Insulated Wire Co., 17 W. 60th St., New York.
Power, Inc., Harold J., Medford Hillside, Mass. (Adapters).
Radio Receptor Co., 106 Seventh Ave., New York, N. Y. (Adapters.)
Riga. See Birnbach Radio Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio. (Adapters).
Wilkens Mfg. Co., 52 Orawaupun St., White Plains, N. Y.

Gage List of
Electrical Buyers
The Trade Authority

RADIUM POWDER AND PAINT

Radium Dial Co., 3333 Forbes, Pittsburgh, Pa.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y.

RANGE SWITCHES, Rotary Snap. See Switches, Snap, Heavy Duty.

RAWHIDE GEARS. See Gears & Pinions, Rawhide.
READING LAMP BASES. See Bases, Reading Lamp.
REAMERS, Pipe. See Stocks, Dies and Reamers.
RECEPTACLES, Lamp. See Sockets and Receptacles.

RECEPTACLES, Plug, Heavy Duty

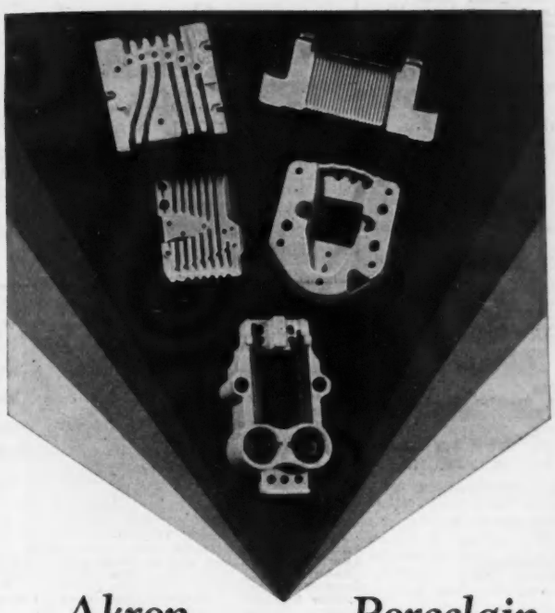
	KEY
Battery Charging	See B
Floor Boxes	See F
Welding	See W
Machine Tool	See W
Watertight, Marine, Mine	See M
Car Trailer Connection	See C
Extension	See E

A. B. C. See Andersen Mfg. Co.
Adam Electric Co., Frank, St. Louis, Mo. F
Adapti Co., 2996 E. 72nd, Cleveland, O. F
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass. B W M C E
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill. M
Arktite. See Crouse-Hinds Co.
Arnessen Electric Co., 13 Water, New York M
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. F B W
Auth Electrical Specialty Co., 422 E. 53rd, New York, N. Y. E
Benjamin Elec. Mfg. Co., Des Plaines, Ill. F W M
Bryant Elec. Co., Bridgeport, Conn. (Also Range Type.) W
Campbell. See Steel City Elec. Co.
Cannon Elec. Development Co., 420 West Ave., 33, Los Angeles, Cal. F
C. E. M. Co. See Conn. Elec. Mfg. Co.
C. H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. M
Condulette. See Crouse-Hinds Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. F
Cory & Son, Chas., 183 Varick, New York M
Crouse-Hinds Co., Syracuse, N. Y. B W
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis. F
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa. C
Elwell Parker Elec. Co., 4222 St. Clair Ave., N. E., Cleveland, O. B
Fielding. See Stanley & Patterson.
Fountain's. See Jenkins Mfg. Co.
Fullman Mfg. Co., Latrobe, Pa. F
Fullman. See Steel City Elec. Co.
General Elec. Co., Merchandise Dept., Bridgeport, Conn. B
Gleason & Co., J. L., 241 Franklin, Boston, Mass. E
H. & H. See Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. B W
Hessel Co., W. F., 76 Greenwich, New York, N. Y. W M E
Hubbell, Inc., Harvey, Bridgeport, Conn. (Also Range Type.) B W
Indestructible. See Kliegl Bros. Universal.
Jenkins Mfg. Co., Bloomfield, N. J. E
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. F B W M
Latrobe. See Fullman Mfg. Co.
Lexington Electric Products Co., 12 Chapel, Newark, N. J. C
Loeffelholz & Co., Milwaukee, Wis. C
Major Equipment Co., 4603 Fullerton Ave., Chicago, Ill. M
Neco. See Novelty Elec. Co.
NePage McKenny Co., Seven Front, Seattle, Wash. F
Novelty Elec. Co., Tench & Cherry Sts., Philadelphia, Pa. C
Ohio Elec. & Controller Co., 5903 Maurice Ave., Cleveland, Ohio W
Ostrander Elecl. Works, W. R., 911 Atlantic Ave., Brooklyn, N. Y.
Preset. See Walker Bros. Co.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill. W M C E
Quadrangle Mfg. Co., 32 S. Peoria, Chicago, Ill. (Combination wall bracket and convenience outlet.)
Raleo Mfg. Co., 123 N. Albany Ave., Chicago, Ill.
Russell & Stoll Co., 53 Rose, New York F B W M E
Square D. Co., Detroit, Mich. W
Stanley & Patterson, 150 Varick, New York, N. Y. F E
Steel City Elec. Co., Pittsburgh, Pa. F E
Thomas & Betts Co., 15 Park Place, New York, N. Y. F
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa. M
Walker Bros., 1417 Sansom, Philadelphia F E
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. F B W M
Yale. See Electric Products Co.

RECORDERS, Elapsed Time. See Indicators, Operation.
REDUCERS, Socket. See Socket Reducers.
REFLECTOR LENSES. See Lenses.

REFLECTORS, Porcelain Enameled, Steel

4Bolite Reflector Co., 7500 Sherman Ave., Cleveland, O.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Cello, Inc., 96 Prince, New York, N. Y.
Dunlap Co., John, Carnegie, Pa.
Durex. See Wheeler Reflector Co.
Federal Electric Co., 8700 S. State, Chicago, Ill.
Goodlites. See Goodrich Elec. Co.
Goodrich Elec. Co., 1650 Ogden Ave., Chicago, Ill.
Isolux. See Wheeler Reflector Co.
Ivanhoe Division of Miller Co., Cleveland.
Jumbo. See Quadrangle Mfg. Co.
Marbelite Art Products Co., 140 N. Robey, Chicago, Ill.
Monk, H. E., 18 Warren, New York, N. Y.
Multi Elecl. Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Oamed. See Overbaugh & Ayers.
Overbaugh & Ayers, 411 S. Clinton, Chicago, Ill.
Para Steel. See Wheeler Reflector Co.
Perfection. See Tindall & White.
Philadelphia Elec'l & Mfg. Co., 1228 N. 31st, Philadelphia.
Quad. See Quadrangle Mfg. Co.
Quadrangle Mfg. Co., 32 S. Peoria, Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Sturdor. See Benjamin Elec. Mfg. Co.
Tindall & White, 33 W. 60th, New York, N. Y.



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The Fibroc Insulation Company maintains a large battery of specially designed and equipped punch presses that quickly and economically supply Fibroc punched parts to meet practically any specification.

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2. Chemically stable—unaffected by ordinary solvents.
3. Non-hygroscopic, does not swell, warp or shrink.
4. Great mechanical strength, compact and light in weight.
5. Resists heat, constant 225° F. intermittent up to 275° F.

Send your specifications or blue prints for samples and quotations. Our engineering department will be glad to work with you.

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REFLECTORS, Porcelain Enameled, Steel—Continued
Vaporlux. See Wheeler Reflector Co.
Westinghouse Elec. & Mfg. Co., South Bend, Ind.
Wheeler Reflector Co., 275 Congress, Boston, Mass.

REFRIGERANTS. See Chemicals, Refrigeration.

REFRIGERATION CHEMICALS. See Chemicals, Refrigeration.

REFRIGERATOR CABINETS

Airtite. See Rhinelander Refrigerator Co.
Alaska Refrigerator Co., Muskegon, Mich.
American Refrigerator Corp., Peru, Ind.
Arlington Refrigerator Co., Arlington, Vt.
Athermos. See Gurney Refrigerator Co.
Baldwin Refrigerator Co., Burlington, Vt.
Banta Refrigerator Co., Clearfield, Pa.
Belding-Hall ElectrICE Corp., Belding, Mich.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Bohn Refrigerator Co., St. Paul, Minn.
Cavalier. See Tennessee Furniture Co.
Challenge Refrigerator Co., Grand Haven, Mich.
Champion Refrigerator Co., 296 Lexington Ave., New York.
Crystal Refrigerator Co., Fremont, Neb.
Crysteel. See Benjamin Elec. Mfg. Co.
Dry-Air. See Baldwin Refrigerator Co.
Dry-Cold. See Hill & Co.
Eddy & Sons Co., D., 336 Adams, Boston, Mass.
Erie Art Metal Co. & Erie Metal Furniture Co., Erie, Pa.
General Necessities Corp., General Necessities Bldg., Detroit, Mich.
Gibson Refrigerator Co., Greenville, Mich.
Gloekler Co., Bernard, 1627 Penn Ave., Pittsburgh, Pa.
Gurney Refrigerator Co., Fond du Lac, Wis.
Harder Refrigerator Corp., Cobleskill, N. Y.
Haskelite Mfg. Co., 120 S. La Salle, Chicago, Ill. (Knockdown.)
Heintz Mfg. Co., Front & Olney Aves., Philadelphia, Pa.
Heinz & Munschauer, Superior and Randall, Buffalo, N. Y.
Herrick Refrigerator Co., 1805 River, Waterloo, Iowa.
Hibbard Cabinets, Inc., 6504 Euclid Ave., Cleveland, O.
Hill & Co., C. V., 860 Pennington Ave., Trenton, N. J.
Holderie Bros., Inc., 339 Exchange, Rochester, N. Y.
Howe Scale Co., Rutland, Vt.
Jewett Refrigerator Co., Buffalo, N. Y.
Kingston. See Lorillard Refrigerator Co.
Kleen Kold. See Harder Refrigerator Corp.
Knox Products Co., Fourth & Greenhill Ave., Wilmington, Del.
Knox. See Erie Art Metal Co.
Leonard Refrigerator Co., Div. of Kelvinator Corp., Grand Rapids, Mich.
Liver & Co., C. B., Omaha, Neb.
Loeber Co., Henry G., 151 E. 126th, New York, N. Y. (Ice Cream Cabinet.)
Lorillard Refrigerator Co., 44 Cooper Square, New York.
Louisville Refrigerator Corp., 4460 Louisville Ave., Louisville, Ky.
Louisville Tin & Stove Co., Louisville, Ky.
Mace & Co., L. H., 55 E. 150th, New York, N. Y.
Maine Mfg. Co., Nashua, N. H.
McCray Refrigerator Sales Corp., 2864 Lake St., Kendallville, Ind.
Mowatt Refrigerator Co., 25 Oak Grove, San Francisco, Cal.
Omaha Fixture & Supply Co., 11th and Douglas, Omaha.
Oreole. See Ottenheimer Bros.
Ottenheimer Bros., Baltimore, Md.
Plymetl. See Haskelite Mfg. Co.
Reol. See Ottenheimer Bros.
Reolite. See Ottenheimer Bros.
Rex Mfg. Co., Connersville, Ind.
Rexdale. See Rex Mfg. Co.
Rhinelander Refrigerator Co., Rhinelander, Wis.
Sanitary Refrigerator Co., Fond du Lac, Wis.
Schmidt Co., C., John and Livingston, Cincinnati, O.
Seeger Refrigerator Co., St. Paul, Minn.
Sherer-Gillett Co., 601 W. Washington, Chicago, Ill.
Steegrest. See Heintz Mfg. Co.
Success Mfg. Co., Gloucester, Mass.
Tennessee Furniture Co., Chattanooga, Tenn.
Vogt. See General Necessities Corp.
Ward Refrigerator Co., 6901 S. Alameda, Los Angeles, Cal
White Mountain. See Maine Mfg. Co.
White Seal. See Louisville Refrigerator Co.

REFRIGERATOR CONDENSER UNITS. See Condenser Units, Refrigerator.

REFRIGERATOR FITTINGS

Commonwealth Brass Corp., 5781 Commonwealth Ave., Detroit, Mich.

REGULATORS, Temperature

American Radiator Co., 1807 Elmwood Ave., Buffalo, N. Y. (Mercury Switch Type.)
American Telatherm Co., 1017 Summit, Toledo, O.
American Thermostat Co., 226 Jelliff Ave., Newark, N. J.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa. (Furnace.)
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Basel Mfg. Co., 911 Mulberry, Kansas City, Mo.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Cesco. See Cobb Electric Appliance Co.

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297 Washington St. Newark, N. J.

Cobb Electric Appliance Co., 100 Massachusetts Ave., Boston.
Cook Elec. Co., 2700 Southport Ave., Chicago, Ill.
Davis & Daggett Co., 238 Dwight, Springfield, Mass.
D. & T. Manufacturing Co., 3001 La Salle, St. Louis, Mo.
Electric Automatic Appliance Co., Denver, Col.
Engelhart, Chas., 90 Chestnut, Newark, N. J.
Fabrics Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Gifford Heat Control Systems, 1 Broadway, New York.
Gold Car Htg. & Ltg. Co., 220 36th, Brooklyn, N. Y.
Hart Mfg. Co., Hartford, Conn.
Hermanson Elect. Co., 505 W. 41st, New York, N. Y.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Jewell Mfg. Co., Auburn, N. Y.
Johnson Service Co., 149 Michigan, Milwaukee, Wis.
Lockswitch. See Time-O-Stat Controls Co.
Majestic Electric Appliance Co., San Francisco, Cal.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill. (Mercury Switch.)
Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave., Minneapolis, Minn.
Penn Electric Switch Co., Des Moines, Iowa.
Penn Heat Control Corp., 1207 Race, Philadelphia, Pa.
Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill
Protectostat. See Minneapolis-Honeywell Reflector Regulator Co.
Quick Freeze. See Penn Electric Switch Co.
Ranco. See Automatic Reclosing Circuit Breaker Co.
Sayetime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Simplex Heat Regulator, 2938 Pillsbury Ave., Minneapolis.
Snapon. See Tagliabue Mfg. Co.
Souder-Hornsby Co., Tamaqua, Pa.
Sure Fire See Boston Machine Wks.
Tagliabue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Time-O-Stat Controls Co., Cramblet Engineering Div., 286 Milwaukee Ave., Milwaukee, Wis.
Trent Co., Harold E., 439 N. 12th, Philadelphia, Pa.
Webster Elec. Co., Racine, Wis.
White Mfg. Co., 2362 University Ave., St. Paul, Minn.
Wilcolator Co., Newark, N. J.
Wilson-Maeulin Co., 383 Concord Ave., New York, N. Y.

REGULATORS, Voltage

Ward-Leonard Electric Co., Mount Vernon, N. Y.
Rotor. See Ward-Leonard Electric Co.

RELAYS

(See also Circuit Breakers and Thermostats.)
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Burke Controller Co., 569 Lexington Ave., New York, N. Y
Dunco. See Struthers Dunn, Inc.
General Electric Co., Schenectady, N. Y.
Leach Relay Co., 693 Mission, San Francisco, Cal.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Wilcolator Co., Newark, N. J.

REMOTE CONTROL SWITCHES. See Switches, Remote Control.

REMOVERS, Coil

Ewing Mfg. Company, Middleport, Ohio.

RESISTANCE

Boxes. See Instruments, Laboratory Standard
Coil Cores. See Cores, Resistance.
Test Sets. See Instruments.
Units, Radio. See Radio Circuit Components.
Units. See Units, Rods & Grids.
Wire. See Wire Bare.

RESISTORS

Lauts Mfg. Co., 245 N. J. R.R. Ave., Newark, N. J.
Ohmite Mfg. Co., 636 N. Albany Ave., Chicago, Ill.

RESISTORS. See Units, Rods & Grids.

RESURFACERS, Commutator. See Stones, Commutator, also Tools, Commutator Truing.

REVOLUTION COUNTERS. See Tachometers.

RHEOSTATS,
Motor-Controlling. See Controllers, also Rheostats.
Radio. See Radio Receiver Parts.
Sewing Machine. See Controllers.

RHEOSTATS

KEY

Battery Charging ..... See B
Stage Dimming ..... See D
Meter Testing (Laboratory) ..... See L
Plating Tank ..... See P
Motion Pictures (Projector Lamp) ..... See M
Motor Starting, Field and Speed Regulating. See F

	F	B	D	P	M	L
Allen-Bradley Co., 484 Reed, Milwaukee						L
Biddle, James G., 1211 Arch, Philadelphia						L
Brach Mfg. Corp., L. S., Newark, N. J. (Radio Battery Control.)		B				
Bradleystat. See Allen-Bradley Co.						
Columbia Electric Mfg. Co., 1292 E. 52nd, Cleveland, O.				P		
Controlite. See Ward Leonard Elec. Co.						
Crown Rheostat & Supply Co., 1908 Maypole Ave., West Chicago, Ill.				P		
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.	F	B	D			L
Economic Rheostat Switch Co., 3551 N. 5th, Philadelphia, Pa.	F					
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.	F					
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O.		B				
General Electric Co., Schenectady, N. Y.	F					L
Hanson-Van Winkle-Munning Co., Matawan, N. J.				P		
Holzmuller, C. J., 1108 Howard, San Francisco, Cal.			D			
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y.			D		M	
Knoeller Elec. Co., De Pere, Wis.	F					
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago	F	B	D		M	L
Optimus. See Hanson-Van Winkle-Munning Co.						
Robertson, Leo F., Inc., 523 W. 22nd, New York, N. Y.					M	
Rubicon Co., 29 W. Sixth, Philadelphia, Pa.						L
Schaefer Bros. Co., 1059 W. 11th, Chicago		B				
Simplicity. See Cutler-Hammer Mfg. Co.						
Union Elec. Mfg. Co., 934 Juneau Ave., Milwaukee, Wis.	F					
Universal. See Ward Leonard Elec. Co.						
Vitrohm. See Ward Leonard Elec. Co.						
Ward Leonard Elec. Co., 31 South, Mt. Vernon, N. Y.	F		D		M	
Watton. See Electric Products Co.						
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.	F				M	

RINGS Seal. See Packing.

RIVETS

American Brass Co., Waterbury, Conn.
Blake & Johnson Co., 1497 Thomaston Ave., Waterville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.

Census of Distribution—

On page 19 of this issue of ELECTRICAL MANUFACTURING, F. M. Feiker tells how the Department of Commerce has plans under way for taking the 1930 census which will include a count of the sources of commercial distribution.

Chicago Rivet & Specialty Co., 1830 S. 54th, Chicago, Ill.
Hassall, Inc., John, 402 Oakland, Brooklyn, N. Y.
Hungerford Brass & Copper Co., Div. of The Chase Brass Companies, Inc., 88 Lafayette, New York, N. Y.
Manufacturers Belt Hook Co., 1315 W. Congress, Chicago, Ill.
Nelson Rivet Co., Taunton, Mass.
Stimpson Co., Edwin B., 70 Franklin Ave., Brooklyn, N. Y.
Thomson Mfg. Co., Judson L., Waltham, Mass.
Tubular Rivet & Stud Co., 87 Lincoln, Boston, Mass.
Waterbury Brass Goods Co., Waterbury, Conn.
Wright & Corson Mfg. Co., Bridgeport, Conn.

RODS, Resistance. See Units, Rods and Grids.

ROLLER BEARINGS. See Bearings, Ball and Roller.

ROLLS, Coil Flattening

Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

RUBBER BELTS. See Belts, Rubber.

RUBBER, Hard

Hard Rubber, Ebonite, Vulcanite.
Astna Rubber Co., 815 E. 79th, Cleveland, O.
American Hard Rubber Co., 11 Mercer, New York, N. Y.
Connecticut Hard Rubber Co., West Haven, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Luzerne Rubber Co., Muirhead, near Dewey, Trenton, N. J.
Mahoganite. See American Hard Rubber Co.
New York Hard Rubber Turning Co., 212 Centre, New York.
Panelyte Corp., Trenton, N. J.
Radiolite. See Superior Hard Rubber Co.
Stokes Rubber Co., Trenton, N. J.
Superior Hard Rubber Co., Butler, N. J.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Vulcanized Rubber Co., 251 4th Ave., New York, N. Y.
Vulco Panels. See Vulcanized Rubber Co.

RUBBER, MECHANICAL GOODS

Goodrich Rubber Co., B. F., Akron, O.
Manhattan Rubber Mfg. Co., Passaic, N. J.
Republic Rubber Co., Youngstown, O.
Sun Rubber Co., Barberton, O.
Toycraft Rubber Co., Dept. W., Ashland, O.

RUBBER, SEMI-HARD. See Rubber Mechanical Goods.

RUBBER, Sponge

Sun Rubber Co., Barberton, O.
Toycraft Rubber Co., Dept. W., Ashland, O.

RUBBER TAPE. See Tape, Rubber and Friction.

RUBBER TUBING. See Tubing, Rubber.

RUST PROOFING. See Plating & Finishing.

SAL AMMONIAC. See Chemicals, Battery.

SALTS, Battery. See Chemicals, Battery.

SATURATING TANKS. See Wire Manufacturing Machines

SCREW SHELLS, Socket. See Shells, Screw Socket.

SCREW DRIVING MACHINES

Vim Electric Tool Co., 149 Broadway, New York, N. Y.

SCREW MACHINE PRODUCTS

Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh, Pa.
American Metal Wks., 4805 Stanton Ave., Philadelphia, Pa.
Barnes Co., Wallace, Bristol, Conn.
Blake & Johnson Co., 1497 Thomaston Ave., Waterville, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Brighton Screw & Mfg. Co., 1456 Harrison Ave., Cincinnati, O.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Colonial-Premier Co., 225 W. Ohio, Chicago, Ill.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Hanson, Einar B., 17 Hermon, Worcester, Mass.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Indianapolis Screw Products Co., 621 N. Noble, Indianapolis.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Linden & Co., 891 Broad, Providence, R. I.
Meisel Press Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Olsen Mfg. Co., 56 Commercial, Worcester, Mass.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Shimer & Sons, Samuel J., Milton, Pa.
Steiner & Co., 227 Washington, Newark, N. J.
Thomaston Mfg. Co., Thomaston, Conn.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Wilmington Fibre Specialty Co., Wilmington, Del.

SCREWS, Cap (Cut Thread)

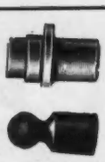
Bristol Co., Waterbury, Conn.
Hartford Machine Screw Co., Hartford, Conn.

SCREWS, Drive

Parker-Kalon Corp., 190 Varick, New York, N. Y.

SCREWS, Machine

Blake & Johnson Co., 1497 Thomaston Ave., Waterville, Conn.
Chicago Nut Mfg. Co., 2512 Cullerton, Chicago, Ill.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Eleo Tool & Screw Corp., Rockford, Ill.



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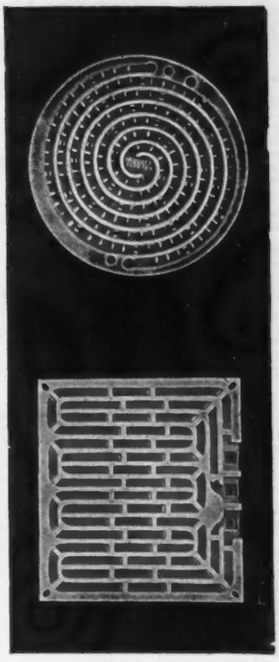

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SCREWS, Machine—Continued
Hubbell, Inc., Harvey, Bridgeport, Conn.
New England Screw Co., Dept. A, 44 Farnsworth, Boston.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Strong, Carlisle & Hammond, 1392 W. Third, Cleveland, O.

SCREWS, Machine (Cut Thread)
American Screw Co., Providence, R. I.

SECOHMMETERS. See Instruments, Laboratory Standard.
SEGMENTS. See Discs, Armature.

SEPARATORS, Storage Battery
Baltimore Battery Separator Co., Baltimore, Md.
Campbell Elec. Co., Kansas City, Mo.
Carlile & Doughty, 2530 N. Broad, Philadelphia, Pa.
Chattanooga Battery Box Co., Chattanooga, Tenn.
Certified. See Ernet Products Co.
Ernet Products Co., Sherman Drive & 16th, Indianapolis, Ind. (Wood.)
Estes & Sons, E. B., 25 Vanderbilt Ave., New York. (Wood.)
Indianapolis Box & Separator Co., 1450 E. 19th St., Indianapolis, Ind. (Wood.)
Indianapolis Mfg. Co., Indianapolis, Ind.
Inseco. See Indianapolis Box & Separator Co.
Link & Hemrick, Inc., 555 W. 52nd, New York, N. Y.
Red Band. See Indianapolis Mfg. Co.
Stewart Mfg. Co., Wm. E., 14th & Elm, Flint, Mich. (Wood.)
Wick Lumber Co., R., 539 W. 52nd, New York. (Wood.)

SHADES
Aluminum. See Shades, Metallic.
Asbestos. See Shades, Fabric.
Bamboo. See Shades, Fabric.
Brass. See Shades, Metallic.
Cast Metal. See Shades and Domes.
Copper. See Shades Metallic.
Cretonne. See Shades, Fabric.
Leaded. See Shades and Domes.
Leather. See Shades, Fabric.
Linen. See Shades, Fabric.
Mica. See Shades, Mica.
Molded. See Molded Insulation.
Mosaic. See Shades and Domes.
Paper. See Shades, Fabric.
Parchment. See Shades, Fabric.
Silk. See Shades, Fabric.
Stamped Metal. See Shades, Metallic; also Shades and Domes.
Steel. See Shades, Metallic.
Tin. See Shades, Metallic.
Zinc. See Shades, Metallic.

SHADES, Fabric
Asbestos Cretonne, Leather, Linen, Paper, Silk, Bamboo Parchment.
Acme Lamp Shade Co., 630 West Jackson Blvd., Chicago. (Silk.)
Adelphi Lamp Shade Co., 242 Fifth Ave., New York. (Silk.)
Admiration Lamp Shade Co., 160 Madison Ave., New York, N. Y. (Silk.)
Andrews Co., C. M., 32 E. 30th, New York, N. Y. (Silk.)
Art Lamp Shade Studios, 316 Fifth Ave., New York, N. Y.
Audrey Art Shade Studios, 105 Thatford Ave., Brooklyn.
Bleck & Co., L. D., 37 E. 18th St., New York, N. Y.
Borghese. See Hall, Chas.
Daiger Co., Charles V., 76 Essex, Boston, Mass. (Silk.)
Eastern Art Shop, 14 W. 19th, New York. (Parchment.)
Foss Parchment Shade Studio, 1338 E. 12th, Oakland, Cal. (Parchment.)
Foslite. See Foss Parchment Shade Studio.
Frostelene. See Art Lamp Shade Studios.
Gibson Art Co., 223 W. Fourth, Cincinnati, Ohio. (Paper.)
Hall, Chas., 3 E. 40th, New York, N. Y. (Paper Parchment.)
Hanson Co., Paul, 15 E. 26th, New York, N. Y. (Chints.)
Harris Mfg. Co., 122 University Place, New York, N. Y. (Parchment.)
Herco Art Mfg. Co., Meriden, Conn.
Hoft Studio, 46 W. 21st, New York, N. Y. (Parchment.)
Idealite Elec. Lamp Shade Mfg. Co., 7 E. 17th, New York, N. Y. (Parchment.)
Kapa Shell. See Wardwell, E. H.
Kerwin. See Hall, Chas.
Kno-Glair. See Hamilton, M. E.
Lamb Bros. & Greene Corp., Napannee, Ind. (Silk.)
Luxrite. See John H. St. John.
Maxwell-Ray Co., Milwaukee, Wis. (Silk.)
Monarch Lamp & Shade Co., 210 N. Second, Philadelphia, Pa. (Silk.)
Morimura Bros., 58 W. 23rd, New York. (Bamboo, Silk, Cretonne.)
Parchment Novelty Co., 87 E. 10th, New York, N. Y. (Parchment.)
Patent Lamp Shade Co., 1361 Frankford Ave., Philadelphia.
Peerless Lamp Shade Mfg. Co., 114 E. 25th, N. Y. (Silk
R. D Electric Co., Fort Wayne, Ind. (Linen and Silk.)
Reuter, Wm., 32 W 34th New York, N. Y. (Silk.)
Rindsberger Mfg. Corp., 18 E. 24th, Chicago, Ill.
Rosita Studio, 10 W. 28th, New York, N. Y. (Parchment and Leatherette.)
Sanderson's Art Co., Milwaukee, Wis. (Parchment.)
Springel & Son, A., 26 S. 3rd, Philadelphia, Pa.
St. John, John H., 1298 Atlantic Ave., Brooklyn, N. Y. (Silk.)
Straus-Hohenstein Co., 133 W. 21st, New York. (Silk.)
Superior Lamp Shade Manufacturers, 72 Madison Ave., New York, N. Y. (Silk.)
Tombs Studios, Wm. H., 172 Pennsylvania Ave., Newark, N. J. (Parchment Paper.)
Trio Mfg. Co., 610 N. American, Philadelphia, Pa. (Silk.)
Troy Art Studio, 424 2d Ave., Troy, N. Y.
Utility Shade Co., Tenafly, N. J.
Vogue Lamp & Shade Co., 130 W. 17th, New York, N. Y. (Parchment.)
Volkman & Co., 2222 W. Lake, Chicago, Ill.
Wardwell, E. H., 11 E. 36th, New York, N. Y.

SHADES AND DOMES
Leaded, Mosaic or Figured, Stamped or Cast Metal.
Art Shade Co., 224 N. Desplaines, Chicago, Ill.
Badanes Mfg. Co., 62 Greene, New York, N. Y.
Bayley & Sons, 105 Vanderveer, Brooklyn, N. Y.
Mutual Sunset Lamp Co., 21 E. Houston, New York, N. Y.
Western Art Glass Shade Works, 101 Turk, San Francisco.

SHADES, FACTORY WINDOW. See Window Shades, Factory.

SHADES, Metallic
Tin, Aluminum, Brass, Copper, Zinc, Steel.

Fair Haven Marble & Marbleized Slate Co.
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Purposes, Natural
Black, Oil Finish
Quarries:
Monson, Maine
Office, Portland, Maine

A. A. Elec. Mfg. Co., Bridgeport, Conn. (Sole selling agent, Harry Pickhardt, 129 W. 15th, New York, N. Y.)
Durex. See Wheeler Reflector Co.
Faries Mfg. Co., Decatur, Ill. (Brass, Aluminum, Tin, Copper.)
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. (Aluminum, Brass, Zinc, Iron, Steel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Aluminum, Brass, Steel, Tin.)
Miller Co., Meriden, Conn.
Monk, H. E., 18 Warren, New York, N. Y. (Tin, Aluminum, Brass, Copper, Zinc & Steel).
Oamco. See Overbaugh & Ayres Mfg. Co.
Overbaugh & Ayres Mfg. Co., 411 S. Clinton, Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Western Reflector Co., 1221 W. Madison, Chicago. (Tin.)
Wheeler Reflector Co., 275 Congress, Boston, Mass.

SHADES, Mica
Hirsch Mica Co., 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
Kant-Krack. See Huse Liberty Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Tarmilite. See Tar Heel Mica Co.

SHAFT COUPLINGS. See Couplings, Shaft.
SHAFTS, Flexible. See Tubing, Flexible Metallic.

SHEARS, Insulation
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.

SHEET STEEL CABINETS. See Cabinets, Sheet Steel.

SHELLS, Screw Socket
Chase Brass & Copper Co., Waterbury, Conn.
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
Patton-MacGuyer Co., Providence, R. I.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Torrington Mfg. Co., 70 Franklin, Torrington, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button & Moulding Co., Waterbury, Conn. (Miniature.)

SHUNTS, Instruments. See Instruments, Laboratory Standard.
SIGN FLASHERS. See Flashers, Sign.
SIGN LETTER LENSES. See Lenses.

SILICA
Ottawa Silica Co., Ottawa, Ill. "Flint Shot."

SILK, Cloth Insulated. See Cloth & Paper.
Shades. See Shades, Fabric.
Tape. See Tape.
Thread. See Yarn, etc.

SILVER, Metal and Wire
Baker & Co., Inc., 54 Austin, Newark, N. J.
Gilby Wire Co., Riverside Ave., Newark, N. J.
Handy & Harman, 57 William, New York, N. Y.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SILVER SOLDER. See Solder, Silver.
SINE WAVE OSCILLATORS. See Instruments, Laboratory Standard.
SIGN ELECTRODES, Gas. See Electrodes for Gas Signs.
SKINNERS WIRE. See Scrapers.
SLABS, Switchboard. See Asbestos Slabs; also Molded Insulation, Slate; Soapstone.

SLATE
For Switchboard Slabs and Barriers.
Davis Slate & Mfg. Co., 618 E. 40th, Chicago, Ill.
Electrical Specialties Corp., 50 Pearl, Boston, Mass.
Fair Haven Marble & Marbleized Slate Co., Fair Haven, Vt.
Penrhyn Slate Co., Hydeville, Vt.
Portland-Monson Slate Co., Portland, Me.
Structural Slate Co., Pen Argyl, Pa.

SLEEVE-BEARINGS. See Bearings and Bushings.
SLEEVING, Cotton. See Tape, Cotton.
SLOTTING FILES. See Files, Commutator Slotting.

SLOTTING MACHINES and TOOLS, Commutator
(Mica Undercutters).
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Hobart Bros. Co., Troy, Ohio.
Hullhorst Micro Tool Co., 3240 E. Monroe, Toledo, O.
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, Ohio.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ransom & Randolph Co., Superior & Chestnut, Toledo, Ohio
Simplex. See Weidenhoff, Joseph.
South Bend Lathe Works, 425 E. Madison, South Bend, Ind.
Weidenhoff, Joseph, 4152 Roosevelt Rd., Chicago, Ill.
White Dental Mfg. Co., S. S., 152 W. 42nd, New York.

SNAP SWITCHES. See Switches, Snap

SOAPSTONE
For Switchboard Slabs and Barriers.
Alberene Stone Co., 153 W. 23rd, New York, N. Y.
Kirchberger & Co., Inc., 1425 37th, Brooklyn, N. J.
Lin-Stun. See Westinghouse.
Westinghouse Elec & Mfg. Co., East Pittsburgh, Pa.

SOCKET LININGS. See Linings, Socket
SOCKET SHELLS. See Shells, Screw Socket.
SOCKETS, Flashing. See Flashers, Sign.

SOCKET Chain Attachments
Chain Links, Chain Adjusters, Acorns, Extensions, Insulated Chain Splicers.

Abbott. See Harvey Hubbell, Inc.
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Bryant Electric Co., Bridgeport, Conn.
Duplex. See Warner Bros. Co.
Eade, John E., 104 Point, Providence, R. I. Links, Insulators.
Easylite. See Rittenhouse Co., A. E.
Economy. See Harvey Hubbell, Inc.
Fiery, Wm. E., 38 W. 32nd, New York, N. Y. (Decorative Pull Chains.)
Gripper. See Wittenberg Bros.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. (Metal Pull Tassel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Links and Acorns, Metal Pull Tassels.)
Paiste. See Hart & Hegeman Mfg. Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y. (Pull Chain Tassel.)
P. & S. See Pass & Seymour, Inc.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Royal. See Sears, Henry D.
Scovil Mfg. Co., Waterbury, Conn. (Acorn.)
Sears, Henry D., 50 Boylston, Boston, Mass
Waterbury Brass Goods Co., Waterbury, Conn. (Acorns.)
Weber. See Sears, Henry D.
Wittenberg Bros., 60 Shipman, Newark, N. J. Links, Ins.

SOCKET REDUCERS
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Benjamin Elec. Mfg. Co., Des Plaines, Ill.
Can-del-lite. See Sears, Henry D.
Eagle Electric Mfg. Co., 59 Hall, New York, N. Y.
Electric Co., 94 Allyn, Hartford, Conn.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Hart & Hegeman Div. of Arrow-Hart & Hegeman Elec. Co. Hartford, Conn.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Propp Co., M., 524 Broadway, New York, N. Y.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sears, Henry D., 50 Boylston, Boston, Mass.

SOCKETS, Radio. See Radio Receiver Parts.

SOCKETS AND RECEPTACLES, Lamp
Bases other than Standard (or Medium) are indicated as follows: Mogul, M; Candelabra (or Miniature), C.

Key ..... See K
Composition ..... See W
Metal Shell ..... See B
Porcelain ..... See A
Pull Chain ..... See P
Push Through ..... See T
Sign Receptacles ..... See A

A. B. C. See Leviton Mfg. Co.
Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. ..... A
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo. ..... W
Alabax. See Arrow Elec. Co.
Alcor Mfg. Co., 4605 W. Madison, Chicago, Ill. C
Appleton Electric Co., 1730 Wellington Ave., Chicago, Ill. ..... A
Armstrong & White, 9th and Liberty Ave., Pittsburgh, Pa. ..... A
Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. M C K T P B A
Arrogrip. See Arrow Elec. Co.
A. & W. See General Outdoor Adv. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. ..... C . . . P B .
Best. See United States Elec. Mfg. Corp.
Bryant Elec. Co., Bridgeport ..... M C K T P B A
C-H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. ..... M . . K T P B A
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. .....
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... M . . K T . . B A
Crouse-Hinds Co., Syracuse, N. Y. ..... A W .....
Cutler-Hammer, Inc., 1287 St. Paul Ave., Milwaukee, Wis. ..... K T . . B A
Durex. See Wheeler Reflector Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. .....
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... P B . .
Far-Go Elec. Mfg. Co., 368 Broome, New York, N. Y. ..... C .....
Federal Electric Co., 8700 S. State, Chicago, Ill. ..... A
Flute. See Pass & Seymour.
Flutelier. See Pass & Seymour.
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. ..... M C . . . . . B . .
Gaynor Elec. Co., Bridgeport, Conn. .....
General Elec. Co., Merchandise Dept., Bridgeport, Conn. ..... M C K T P B A
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn. ..... M C K T P B A
Hoosick Falls Radio & Elec'l Parts Mfg. Co., Hoosick Falls, N. Y. ..... W .....
Horan Co., E. S., 550 Monroe, Carlstadt, N. J. ..... A
Hubbell, Inc., Harvey, Bridgeport, Conn. M C K T P B A
H. & H. See Hart & Hegeman.
I-D-A. See Watson Mfg. Co., J. E.
K-E Cleat Receptacle. See Kirkman.
Kirkman Engineering Co., 1 Dominick, New York. (Cleat Receptacle.) .....
Leader. See Leviton Mfg. Co.
Leiser & Co., W. A., 1607 Sansom, Philadelphia, Pa. ..... A
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y. ..... M C K . . P B A
Levolier. See McGill Mfg. Co.
Liberty Bell. See Hart & Hegeman.
Locat-A-Catch. See Connecticut.
McGill Mfg. Co., Valparaiso, Ind. ..... P B A
Majestic Elec. Mfg. Co., 806 N. 12th, St. Louis. (Lamp Receptacle.) ..... A
Molded Socket Corp., Railroad, Pa. ..... K .....
Multi Elec'l Mfg. Co., 1840 W. 14th, Chicago, Ill. ..... A
Multilok. See Circle F Mfg. Co.

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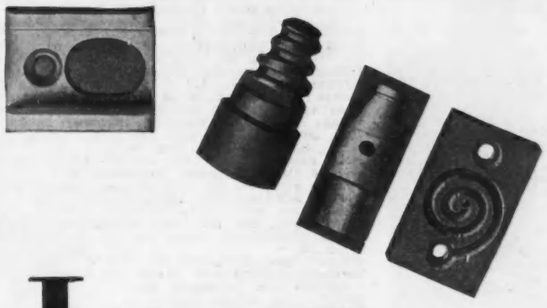

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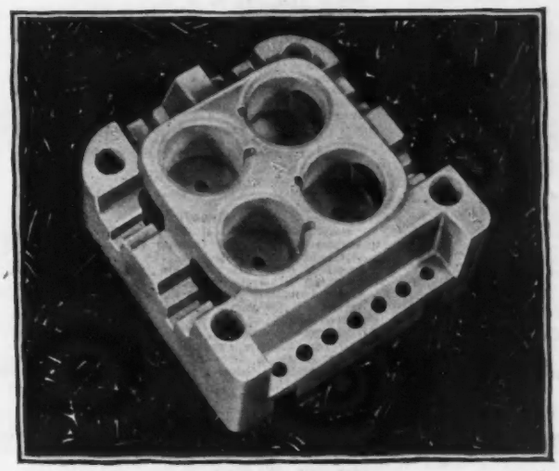
"Toyco" Sponge Rubber may be had in standard sheets 20" x 20" in many degrees of density —and die-cut or moulded for special purposes.

Send your blueprints or detailed specifications for full particulars and prices.

The Toycraft Rubber Company
Dept. "W"
Ashland, Ohio



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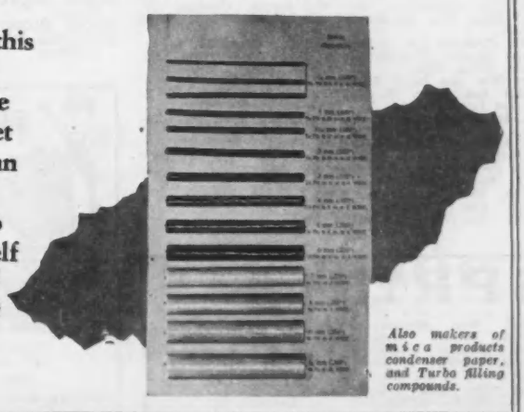

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Paulding, John L., New Bedford, Mass. ..... B A
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Union Insul. Co., Parkersburg, W. Va. .....
United States Elec. Mfg. Corp., 223 W. 14th, New York, N. Y. ..... P .. B .. W
U. S. Electric Co., 311 Chambers St., Trenton, N. J. ..... A
Walco. See Leiser & Co., W. A.
Waterbury Button & Moulding Co., Waterbury, Conn. .....
Watson Mfg. Co., J. E., 5506 N. Fifth, Philadelphia, Pa. (Concealed Fixture) ..... P B ..
Weber. See Sears, Henry D.
Wheeler Reflector Co., 275 Congress St., Boston, Mass. ..... P ....
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Woodwin. See Wood Elec. Co.
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Supreme. See Lasher-Weeber Co.
Union Smelting & Refining Co., Newark, N. J.
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Genuine A. See Hoyt Metal Co.
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Gardiner Metal Co., 1366 W. Lake, Chicago, Ill.
Kester Solder Co., 4210 Wrightwood Ave., Chicago, Ill.
Lenk Mfg. Co., 32 Merrimac, Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
Silva-Wares, Inc., 134 W. 26th St., New York, N. Y.
Solderall Co., 129 Sussex Ave., Newark, N. J.
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Lukens Metal Co., T. F., 1105 Fairmount Ave., Philadelphia, Pa.
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Solderite, Inc., 22 Green, Newark, N. J.
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Star. See McGill Mfg. Co.
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Technical Products Co., Pittsburgh, Pa. (Paste.)
Tinol. See American Solder & Flux Co.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago, Ill.
Weaver Specialty Co., 6344 Aurelia, Pittsburgh, Pa.
Yager's. See Benson Co., Alex. R.
Yankee. See Leveridge, Inc., Chas. W.

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Adrola Corp., Port Jefferson, N. Y.
American Beauty. See American Elecl. Heater Co.
American Elecl. Heater Co., Detroit, Mich.
B-D. See Bleadon-Dun Co.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beckwith Machine Co., 402 N. Chestnut, Ravenna, Ohio.
Betsy Ross. See Central Flatiron Mfg. Co.
Bleadon-Dun Co., 2300 Warren Ave., Chicago, Ill.
Brach Mfg. Corp., L. S., Newark, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Central Flatiron Mfg. Co., Johnson City, N. Y.
Chapman Machine Co., Terryville, Conn.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
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Dominion Elec'l Mfg. Co., 712 Ontario Ave., N., Minneapolis.
Dover Mfg. Co., Dover, O.
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Electrical Products Mfg. Co., Providence, R. I.
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Esico. See Electric Soldering Iron Co.
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Ever-Ready. See Gold Seal Elec. Co.
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Gold Seal Elecl. Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
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Industrial. See Permway Mfg. Co.
Jiffy. See Koch & Co., Paul W.
Junior. See Drake Elec. Wks.
King See Electric Heat Control Co.
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Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
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Silver King. See Illinois Stamping & Mfg. Co.
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Superior Elec. Products Corp., 1300 S. 13th, St. Louis, Mo.
Swartzbaugh Mfg. Co., 1501 W. Bancroft, Toledo, O.
Torrid. See Beardsley & Wolcott Mfg. Co.
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Balco. See Simons Paint Spray Brush Co.
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Binks Spray Equipment Co., 3120 Carroll Ave., Chicago, Ill.
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Koch Bros. Mfg. Co., 2339 Nelson, Chicago, Ill.
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Newcomb Spring Corp., 234 40th, Brooklyn, N. Y.
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Raymond Mfg. Co., Corry, Pa.
Standard Spring and Manufacturing Co., 236-42nd St., Brooklyn, N. Y.
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Wallace Barnes Co., Bristol, Conn.
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STAMPED BOXES. See Cabinets, Sheet Steel.

STAMPINGS, Fibre. See Fibre.
Sheet Metal. See Fixture Fittings.
Sheet Steel. See Stampings, Sheet Steel.
Small. See Stampings, Small.

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Bossert Corp., Utica, N. Y.
Eureka Tinware Mfg. Co., 135 W. 20th, New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
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Janney, Steinmetz & Co., 1421 Chestnut St., Philadelphia.
Massachusetts Machine Shop, Inc., Boston, Mass.
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Mullins Mfg. Corp., Washing Machine Division, Salem, Ohio. (Vitreous Enameled)
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Truscon Steel Co., Youngstown, O.
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Aerial Machine & Tool Co., 79 Grand, New York, N. Y.
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Clarke Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
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Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros. Co., Piano, Ill.
Hubbard Spring Co., M. O., Pontiac, Mich.
Hubbell, Inc., Harvey, Bridgeport, Conn.
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Lansing Stamping Co., Lansing, Mich.
Lenz Metal Stamping Wks., J., 199 Franklin, New York.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
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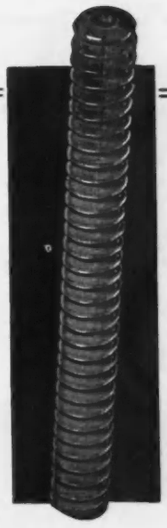

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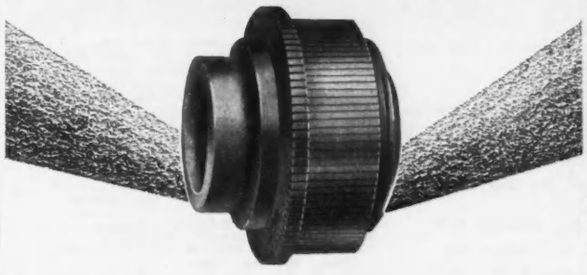

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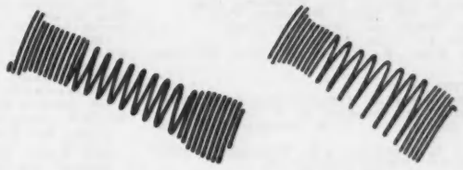

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Valley Appliances, Inc., 634 Lexington Ave., Rochester, N. Y.
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Waterbury Button & Moulding Co., Waterbury, Conn.
Waterbury Mfg. Co., 256 Grand, Waterbury, Conn.
Waterbury Metal Wares Co., Waterbury, Conn.
Western Cartridge Co., East Alton, Ill.
Zierick Machine Wks., F. R., 64 E. 131st St., New York, N. Y.

STANDS, Armature

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Electric Service Supplies Co., 17 & Cambria Sts., Philadelphia, Pa.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

STARTERS, Motor. See Controllers, Motor; Switches, Remote Control; Switches, Knife; Safety; Switches, Snap (Heavy Duty).

STEATITE. See Cores, Resistance Coil.

STEEL CASTINGS. See Castings, Steel.

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Indiana Steel Products Co., 4545 S. Western Ave., Chicago
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Armelec. See Empire Steel Corp.
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Cyclops Steel Co., Titusville, Pa.
Dynelec. See Empire Steel Corp.
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Firth-Sterling Steel Co., McKeesport, Pa.
Manelec. See Empire Steel Corp.
Metelec. See Empire Steel Corp.
Newport Rolling Mill Co., Newport, Ky.
Polelec. See Empire Steel Corp.
Republic Iron & Steel Co., 335 Market, Youngstown, O
Tranelec. See Empire Steel Corp.
Unilov. See Universal Steel Co.
Universal Steel Co., Bridgeville, Pa.
Wheeling Steel Corp., Wheeling, W. Va.

STEEL, STRIP. See Strip Steel.

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Red-E-Hall. See Hall-Will, Inc.
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Caro. See Electric Service Supplies Co.
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Co-operative Utilities Co., 1503 Columbia Ave., Philadelphia, Pa.
Diamond Dee. See Co-operative Utilities Co.
Electric Service Supplies Co., 17th and Cambria, Philadelphia, Pa.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Lombard & Co., Somerville, Mass.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.

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Royal Metal Mfg. Co., 1136 South Michigan Ave., Chicago.

STORAGE
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STRAINING MACHINES, INSULATION. See Wire Manufacturing Machines.

STRAIGHTENERS, Armature Shaft

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STRANDING MACHINES. See Wire Manufacturing Machines.

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Athenia Steel Co., 135 William, New York, N. Y. (Cold.)
Barnes Co., Wallace, Bristol, Conn. (Hot.)
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Griffin Mfg. Co., Huron & Cherry, Erie, Pa. (Cold.)
Laclede Steel Co., 8th & Olive Sts., St. Louis, Mo. (Hot.)
Latrobe Electric Steel Co., Latrobe, Pa. (Hot & Cold.)
Republic Iron & Steel Co., 335 Market, Youngstown, O
Sharon Steel Hoop Co., Sharon, Pa. (Hot.)
Stanley Wks., New Britain, Conn. (Hot & Cold.)
Steel and Tubes, Inc., Cleveland, O. (Hot & Cold.)
Superior Steel Corp., Union Trust Bldg., Pittsburgh, Pa. (Hot & Cold.)
Thomas Steel Co., Warren, Ohio.
West Leechburg Steel Co., Farmers Bank Bldg., Pittsburgh, Pa. (Hot & Cold.)

STRIPPERS, Wire

Acme. See A. Laubscher.
Artos Engineering Co., 115 Brown, Milwaukee, Wis. (Cutting, Stripping and Measuring).
Austin Co., M. B., 108 S. Desplaines, Chicago, Ill.
Colonial-Premier Co., 229 W. Ohio, Chicago, Ill.
Diese Tool Co., Downers Grove, Ill.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
E-Z. See Pyramid Products Co.
F. F. See France Mfg. Co.
France Mfg. Co., 10325 Berea Rd., Cleveland. (Motor Driven.)

Goehst. See Klein & Sons.
Hartman. See Service Sales & Mfg. Co.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Ives Mfg. Co., Meriden, Conn.
Klein & Sons, Mathias, Chicago, Ill.
Laubscher, A., 77 Fort Pleasant Ave., Springfield, Mass.
Perfection. See Weber Machine Corp.
Pyramid Products Co., 2311 S. State, Chicago, Ill.
Service Sales & Mfg. Co., 17005 Meigrave Ave., Cleveland, Ohio.
Speedcraft. See Wire Stripper Co.
Thomas Steel Products Co., Warren, Ohio.
Weber Machine Corp., 33 S. Water, Rochester, N. Y.
Wire Stripper Co., 507 Erie Bldg., Cleveland, O.
Zierick Machine Wks., F. R., 6 Howard, New York City. (Motor Driven Stripper & Twister).

SWITCHBOARD INSTRUMENTS. See Instruments, Portable and Switchboard.

SWITCHBOARD OPALS. See Lenses.

SWITCHBOARDS, SLABS AND BARRIERS
See Asbestos Slabs; Molded Insulation; Slate; Soapstone.

SWITCH (Switches)
Arms. See Posts, Binding.
"Across the Line" Type. See Controllers, Motor.
Baby Knife. See Switches, Battery.
Battery. See Switches, Battery.
Canopy. See Switches, Snap.
Clock Operated. See Switches, Time.
Feed Through. See Switches, Snap.
Fixture. See Switches, Snap.
Float. See Switches, Tank.
Flush. See Switches, Snap.
Handles. See Handles, Wood
Knife, Baby. See Switches, Battery & Baby Knife.
Lever Radio. See Radio Mounting.
Lever. See Switches, Snap, Lever.
Limit. See Controllers, Motor.
Mercury. See Switches, Mercury
Motor Starting. Magnetic Type. See Controllers.
Motor Starting. Non-Magnetic. See Switches, Motor Starting.
Pendant. See Switches, Snap.
Pressure Regulating. See Controllers.
Push Button, Snap. See Switches, Snap.
Push Button, Motor starting. See Switches, Remote Control
Radio Receiver. See Radio Mountings.
Range. See Switches Snap; Heavy Duty
Remote Control. See Switches, Remote Control.
Reversing. See Controllers.
Rotary. See Switches, Snap.
Safety. See Switches, Knife.
Snap. See Switches, Snap.
Starter Type. See Controllers.
Storage Battery. See Switches, Storage Battery.
Surface. See Switches, Snap.
Tank. See Switches, Tank.
Time. See Switches, Time.
Toggle. See Switches, Snap.
Tumbler. See Switches, Snap.

SWITCHES, Battery and Baby Knife

Cut-Out Switches.
Anti-Wood. See Keil & Son, Francis.
Bridgeport Switch Co., 209 Center, Bridgeport, Conn.
Bryant Electric Co., Bridgeport, Conn.
Chapman. See Frank W. Morse & Co.
Chicago Elec. Mfg. Co., 2201 S. Halsted, Chicago, Ill.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Crown. See Edwards & Co., Inc.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Edwards & Co., Inc., 140th & Exterior, New York, N. Y.
Electrad, Inc., 428 Broadway, New York, N. Y.
Eureka. See Frank W. Morse & Co.
Fahnestock Elec. Co., cor. East Ave. and 8th, Long Island City, N. Y.
Handy. See Chicago Elec. Mfg. Co.
H. & H. See Hart & Hegeman Div.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co. Hartford, Conn. (Push Button.)
Harwood. See Frank W. Morse & Co.
Heinemann Elec. Co., Trenton, N. J.
Jost. See Frank W. Morse & Co.
Kappa. See Trumbull Elec. Mfg. Co.
Keil & Son, Francis, 401 E. 163rd, New York, N. Y.
Kendrick & Davis Co., Lebanon, N. H.
Keystone. See Frank W. Morse & Co.
King Mfg. Co., B. C., 302 Park Ave., Brooklyn, N. Y.
Knox Porcelain Corp., Knoxville, Tenn.
K-P-F Elec. Co., 855 Howard St., San Francisco, Cal.
Kurz & Root, Appleton, Wis.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Lyons Mfg. Co. (Mt. Carmel), New Haven, Conn.
Majestic Elec. Mfg. Co., 80 N. 12th St., St. Louis, Mo
Manhattan Elect. Supply Co., 510 Sixth Ave., New York.
Morse Co., Frank W., Boston, Mass.
Partrick & Wilkins Co., Philadelphia, Pa.
Porcelain Products, Inc., Findlay, Ohio.
Powerlite Switchboard Mfg. Co., 4149 E. 79th, Cleveland, O.
Pullrite. See Frank W. Morse & Co.
Reliable Electric Co., 3145 Carroll Ave., Chicago, Ill.
Samson Electric Co., Canton, Mass.
Spero Elec. Mfg. Co., E. 33rd and Woodland Ave., Cleveland
Sta-Rite. See Frank W. Morse & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Wood Elec. Co., C. D., 565 Broadway, New York, N. Y.

SWITCHES, Mercury

(For Temperature Control Apparatus.)
Con-Tac-Tor. See Time-O-Stat Controls Co.
Cooper Hewitt Electric Co., 410 Eighth Ave., Hoboken, N. J.
Cramblet Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Febrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
General Kontroler Co., 200 E. First, Dayton, O.
Kon-nec-tor. See Cooper Hewitt Elec. Co.
Kontax. See General Kontroler Co.
Marrold Corp., 564 W. Adams, Chicago, Ill.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.
Time-O-Stat Controls Co., Elkhart, Ind.

SWITCHES, Motor Starting

Accumatic. See Trumbull-Vanderpoel Elec. Mfg. Co.
Aces. See Colt's Patent Fire Arms Mfg. Co.
Adam Elec. Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Barber Elec. Mfg. Co., North Attleboro, Mass.
Bull Dog Electric Products Co., Detroit, Mich.
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y
Crouse-Hinds Co., Syracuse, N. Y.
E. W. See Trumbull Elec. Mfg. Co.
FA. See Adam Elec. Co., Frank.
F. A. Triumph. See Metropolitan Elec. Mfg. Co.
Federal Steel Products Co., 2 Ave. L., Newark, N. J.
Large-Dail Mfg. Co., 690 Cherry, Philadelphia, Pa.

Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lundy Co., E. A., Fulton Bldg., Pittsburgh.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Major. See Adam Elec. Co., Frank.
Mason. See Trumbull-Vanderpoel Elec. Mfg. Co.
Metropolitan Device Corp., 1250 Atlantic Ave., Brooklyn, N. Y.
Metropolitan Elec. Mfg. Co., Blvd. at 14th, Long Island City, N. Y.
Murray. See Metropolitan Device Corp.
Mutual. See Bull Dog Elec. Products Co.
Naro. See Metropolitan Elec. Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Nublade. See Colt's Patent Fire Arms Mfg. Co.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Robbins & Myers, Inc., Springfield, O.
Safe-Lock. See Trumbull-Vanderpoel Elec. Mfg. Co.
Safelock. See Westinghouse Elec. & Mfg. Co.
Schmuckler & Sons, 2232 N. 28th, Philadelphia, Pa.
Square D Co., Detroit, Mich.
S. S. See Wadsworth Elec. Mfg. Co.
Tanner & Co., Wm. F., 511 Sharp, Baltimore, Md.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
T. V. Safelock. See Trumbull-Vanderpoel Elec.
Unisafti. See Metropolitan Device Corp.
Unit-Versal. See Bull Dog Elec. Products Co.
Universal Metal Box & Products Co.
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Westinghouse Elec. & Mfg. Co., Mansfield, O.

SWITCHES, Remote Control

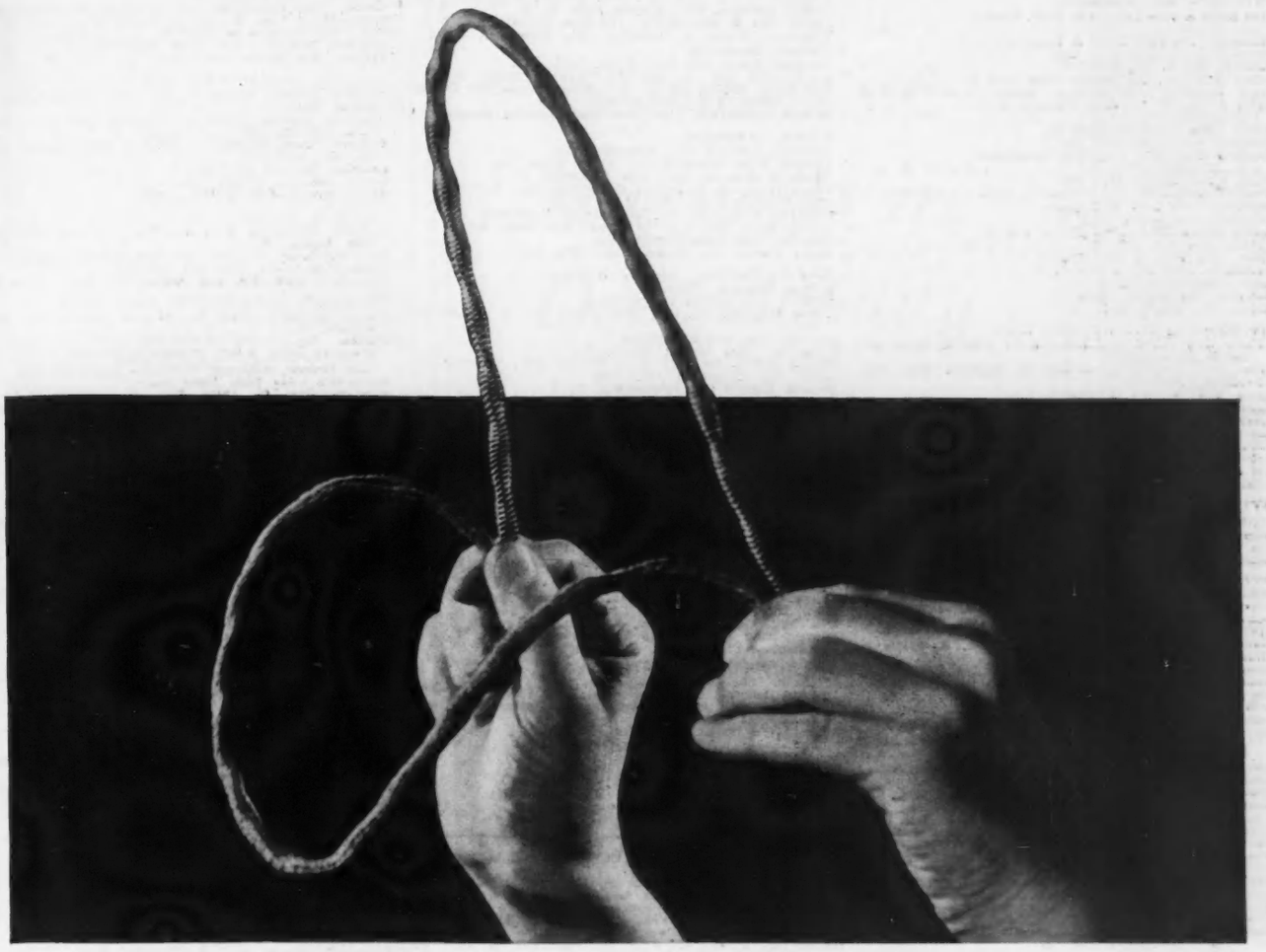
Push Button, Magnetically Operated.
Adam Electric Co., Frank, St. Louis, Mo.
Allen-Bradley Co., 484 Reed, Milwaukee, Wis.
Automatic Switch Co., 154 Grand, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Clark Controller Co., 1143 E. 152nd, Cleveland, O.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Cutler-Hammer, Inc., 1287 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Dunco. See Struthers Dunn, Inc.
Electric Valve Mfg. Co., 68 Murray, New York, N. Y.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
H. P. See Palmer Elec. & Mfg. Co.
Industrial Controller Div. of Square D Co., Milwaukee, Wis.
Kato Engr. Co., Mankato, Minn.
Lincoln Elec. Co., Coit Rd. & Kirby Ave., Cleveland, O.
Major, F. A., System. See Adam Elec. Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Precise Mfg. Co., 254 Mill, Rochester, N. Y.
Protectoswitch. See Precise Mfg. Co.
R. C. O. C. See South Bend Current Controller Co.
Sauter. See Cramer & Co., R. W.
Signal Engineering & Mfg. Co., 146 W. 14th, New York.
South Bend Current Controller Co., South Bend Ind.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Takamine Corp., 208 Rawson St., Long Island City, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore.
Triplock. See Monitor Controller Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

SWITCHES, Snap

KEY	
Feed Through	See p
Fixture (Canopy, Candelabra and Key Arm)	See F
Flush	See f
Lever, Toggle, Tumbler	See L
Pendant	See p
Push Button	See P
Rotary	See R
Surface	See s

See Also Switches, Snap; Heavy Duty.

Adam Electric Co., Frank, St. Louis, Mo.	?								
Anylite Elec. Co., Ft. Wayne, Ind.							L		
Arrow Electric Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.	f	sp	P	R	L	F			
Arrow Head. See Arrow Elec.									
Beaver Mfg. Co., 625 N. Third, Newark, N. J.	f	p	P			F			
Best. See United States Elec. Mfg. Corp.									
Brascolite. See Guth & Co., Edwin.									
Bremer Elec. Mfg. Co., 139 N. 7th, Philadelphia, Pa.	f								
Bridgeport Switch Co., 209 Center, Bridgeport, Conn.							L	F	
Bryant Elec. Co., Bridgeport, Conn.	f	sp	P	R	L	F			
B. S. Co. See Bridgeport Switch Co.									
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn.								F	
Circle F. Mfg. Co., Trenton, N. J.	f		P		L	F			
Circle T. See Trumbull Elec. Mfg. Co.									
Commercial. See Gaynor Electric Co.									
Connecticut Elec. Mfg. Co., Bridgeport, Conn.		p	P	R	L	F			
Crouse-Hinds Co., Syracuse, N. Y.							L		
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee, Wis.			P			L			
Diamond H. See Hart Mfg. Co.									
Dugie. See Bryant Elec. Co.									
Economy Fuse Mfg. Co., 2717 Greenview Ave., Chicago, Ill.								F	
Gaynor Elec. Co., Bridgeport, Conn.	f						L		
General Elec. Co., Merchandise Dept., Bridgeport, Conn.	f	sp	P	R	L	F			
Glo-Guide. See Bryant Elec. Co.									
Gold Star Push Switch. See Hart & Hegeman.									
Guth & Co., Edwin, 2615 Washington Ave., St. Louis, Mo.								F	
Hart Mfg. Co., Hartford, Conn.	f	sp	P	R	L				
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co. (Door Bolt Control)	f	sp	P	R	L	F			
Hart. See Hart & Hegeman.									
H. & H. See Hart & Hegeman Mfg. Co.									
Hubbell, Inc., Harvey, Bridgeport, Conn.		sp				L	F		
Jost. See Morse, Frank W.									
Keil & Son, Francis, 401 E. 163rd, New York, N. Y.	f		P						
Leviton Mfg. Co., 226 Newell, Brooklyn								F	
Levolier. See McGill Mfg. Co.									
McGill Mfg. Co., Valparaiso, Ind.	f					L	F		
Marks Products Co., 80 N. Ninth, Brooklyn, N. Y.							L	F	
Metropolitan Elec. Mfg. Co., Blvd at 14th St., Long Island City, N. Y.				s		R			
Morse Co., Frank W., 291 Congress, Boston			P						
National. See Standard Elec. Mfg. Co.									
New England. See Paulding, John L.									
Nutmeg. See Hubbell, Harvey, Inc.									
Operite. See Morse Co., Frank W.									
Pass & Seymour, Solvay Sta., Syracuse, N. Y.	f	sp	P		L	F			
Paulding, John L. New Bedford, Mass.	f	s	P						
Pen Tap. See Beaver Mfg. Co.									
Perkins. See Bryant Elec. Co.									



Test Your Cord

for

Flexibility

Flexibility is a definite quality of Driver-Harris Heater Cord definitely expressed in longer service on your appliance.

Test your cord for quality by taking 2 pieces of heater cord of approximately 18 inches in length, hold 2 ends in each hand as indicated—the flexible cord will *not* remain erect.

Write for copy of booklet—"How to Judge Heater Cord"

DRIVER-HARRIS COMPANY

HARRISON, N.J.

Chicago - Detroit - Morristown, N.J. - England - France
Cleveland Italy

SWITCHES, Snap—Continued

Pilot Radio & Tube Corp., 323 Berry, Brooklyn, N. Y. ..... L ..
Pilotoggle. See Pilot Radio & Tube Corp.
Pilotoggle. See Pilot Elec. Mfg. Co.
Pullrite. See Morse, Frank W.
Rodale Mfg. Co., 200 Hudson, New York p v
Sears, Henry D., 80 Boylston, Boston.. f sp P R L F
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa. ..... P .....
Snapit. See Marks Products Co.
Spartan. See Bryant Elec. Co.
Standard Elec. Mfg. Co., 941 Wrightwood Ave., Chicago, Ill. ..... f s P R L ..
Triple. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. f s P R L ..
Tumbolier. See Hart & Hegeman.
Twi-Lite. See McGill Mfg. Co.
United States Elec. Mfg. Corp., 233 W. 114th, New York, N. Y. ..... f .....
Victor. See Keil & Son, Francis.
Washington. See Gaynor Electric Co.
Weber. See Sears, Henry D.
Werkrite. See Morse, Frank W.
Yankee. See Bryant Elec. Co.

SWITCHES, Snap; Heavy Duty

Heavy duty rotary snap switches for Electric Range and Small Motor Control.

Arrow Elec. Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn.
Diamond H. See Hart Mfg. Co.
Domestic Electric Co., 7723 St. Clair Ave., Cleveland, Ohio.
General Electric Co., Section W-234, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman, Div. of Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.

SWITCHES, Storage Battery; Automatic Disconnecting

Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Penn Electric Switch Co., Des Moines, Ia.
Radiolec. See Cutler-Hammer Mfg. Co.

SWITCHES, Tank

Blackburn-Smith Corp., 25 W. 45th, New York, N. Y.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Electrical Repair Co., 240 W. 25th, New York, N. Y.
General Electric Co., Schenectady, N. Y.
Industrial Controller Div. of Square D Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Leader-Trabern Products Co., Decatur, Ill.
Ostrander Elec. Wks., W. H., 911 Atlantic Ave., Brooklyn.
Penn Elec. Switch Co., 20th & Walnut, Des Moines, Ia.
Sundh Elec. Co., Parkhurst St. at Ave. C, Newark, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, Time (Automatic Clock Operated Switches)

Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Astrachron. See Gem Engineering Co.
Automatic Elec. Heater Co., 1505 Race, Philadelphia, Pa.
Automatic Elec. Mfg. Co., Mankato, Minn.
Automatic Lighting Co., 831 Greenmount Ave., Baltimore.
Automatic Sprinkler Corp. of America, 910 B. of L. E. Bank Bldg., Cleveland, Ohio.
Automatic Timer Co., 1841 Euclid Ave., Cleveland, O.
Berry, A. Hall, 73 Murray, New York, N. Y.
Brown & Pengilly, Inc., 1364 Folsom, San Francisco, Cal.
Buckeye Time Switches, Inc., 1557 St. Clair Ave., Cleveland, O.
Cackle. See Berry A. Hall.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Clark. See Automatic Heater Co.
Con-tac-tor. See Absolute Con-tac-tor Corp.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Frisch, Walter P., 104 Linden, Rochester, N. Y.
Gem Engineering Co., Hempstead, N. Y.
General Electric Co., Schenectady, N. Y.
Go-N-Set. See G. & S. Research Lab.
G. & S. Research Laboratory, 1269 Cochran Ave., Los Angeles, Cal.
Hart Mfg. Co., Hartford, Conn.
Hartford. See Berry A. Hall.
Horni Signal Mfg. Co., 290 Hudson, New York, N. Y.
Jewel. See Time Switch Sales & Service.
Knowles, W. E., 2869 Broadway, Oakland, Cal.
Kwixset. See Thompson Clock Co.
Lamp-Lighter. See Robbins & Myers Co.
Liberty Bell Mfg. Co., Minerva, Ohio.
Mercury Time Switch Co., Marine City, Mich.
Northwestern Clock Co., Omaha, Neb.
Ohio Time Switch Co., 1439 St. Clair Ave., Cleveland.
Paragon Elec. Co., 400 S. Dearborn, Chicago, Ill.
Racine. See Reliance Automatic Ltg. Co.
Radio Owl, 2269 E. 51st, Los Angeles, Cal.
Radio Switchman. See R-V Mfg. Co.
Reliance Automatic Ltg. Co., 1935 Meade, Racine, Wis.
Research Mfg. Laboratory, 1269 Cochran Ave., Los Angeles.
Robbins & Myers Co., Springfield, O.
Ross Safety Switch Corp., 1 E. 42nd, New York, N. Y.
R-V Mfg. Co., Marshfield, Mass.
Sauter. See Cramer & Co.
Stater Co., Hartford, Conn.
Stromberg Electric Co., 225 W. Erie, Chicago, Ill.
Thompson Clock Co., H. C., Bristol, Conn.
Time Switch Sales & Service, 1341 Euclid Ave., Cleveland, O.
York Clocks, Inc., 12 E. 41st, New York, N. Y.
Waiser Automatic Timer Co., 542 Madison Ave., New York.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

TACHOMETERS

Speed Indicators, Speedometers, Revolution Counters.

Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Durant Mfg. Co., 655 Buffum, Milwaukee, Wis.
Electric Tachometer Corp., Spring Garden & Broad St., Philadelphia, Pa.
Holtzer-Cabot Elec. Co., Boston, Mass.
Loeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Productimeter. See Durant Mfg. Co.
Standeo. See Sticht & Co.
Sticht & Co., H. H., 21 Park Row, New York, N. Y.
Veeder Mfg. Co., 14 Sargeant, Hartford, Conn.
Weston Elecl. Instrument Co., 583 Frelinghuysen Ave., Newark, N. J.
Zernickow Co., O., 15 Park Row, New York, N. Y.

TAGS, Cable; Pole and Battery

American Radio Hardware Co., 135 Grand, New York, N. Y. (Battery Lead Tags.)
Benedict Mfg. Co., East Syracuse, N. Y.
Brecklin Underground Elec'l Mfg. Co., Glenside, Pa.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Grammes & Sons, Inc., L. F., Allentown, Pa.
International Tag Co., 319 N. Whipple, Chicago, Ill.

Matthews & Co., Jas. H., 3942 Forbes, Pittsburgh, Pa.
Premax Products, Inc., Niagara Falls, N. Y.
Viking Tool & Machine Co., 745 65th, Brooklyn, N. Y.
Waterbury Button & Moulding Co., Waterbury, Conn.

TAGS, Shipping

Campbell Paper Box Co., South Bend, Ind.
International Tag Co., 319 W. Whipple, Chicago, Ill.

TAMPING TOOLS, COIL. See Tools, Commutator Truing.
TANK SWITCHES. See Switches, Tank.
TANKS, TINNING. See Wire Manufacturing Machines

TAPE, Asbestos

American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
General Asbestos & Rubber Co., Charleston, S. C.
Johns-Manville Corp., New York, N. Y.
Matthews & Co., Jas. H., 3942 Forbes, Pittsburgh, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Niagrite. See Johns-Manville, Inc.
Shield Brand. See Mitchell-Rand Mfg. Co.

TAPE, Cotton, Linen, Silk; Tape, Sleeving, Webbing.

Alfalfa. See Burrell Belting Co.
Anchor Webbing Co., 300 Brook, Pawtucket, R. I. (Cotton, Silk).
Aweco. See Anchor Webbing Co.
Bermaline. See Burrell Belting Co.
Burrell Belting Co., 413 S. Hermitage Ave., Chicago, Ill.
Eagle. See Sidebotham, Inc., John.
General Electric Co., Schenectady, N. Y.
Gilmer Co., L. H., Cottman & Keystone Sts. (Tacony), Philadelphia, Pa.
Hope Webbing Co., 1005 Main, Providence, R. I.
Krout & Fite Mfg. Co., Allegheny Ave. & Emerald, Philadelphia, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sidebotham, Inc., John, 4317 Griscom, Philadelphia, Pa.
Smith Belting Co. (Germantown), Philadelphia, Pa.
Superfine. See Windsor Webbing Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Windsor Webbing Co., Pawtucket, R. I.
Worcester Braiding Co., 34 Southbridge, Worcester, Mass.

TAPE, Mica

Chicago Mica Co., 345 Campbell, Valparaiso, Ind.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Rubber and Friction

Ackerman. See Ackurate Rubber Co.
Ackurate Rubber Co., 25 Beaver St., New York, N. Y.
Adamson & Co., Joseph, Columbia and Germantown Aves., Philadelphia, Pa.
Adhere. See Westinghouse Elec. & Mfg. Co.
Alpha. See Johns-Manville, Inc.
Amazon. See Graybar Elec. Co.
Appleton Rubber Co., Franklin, Mass.
Black Diamond. See Dunton Co., M. W.
Boston Woven Hose & Rubber Co., Boston, Mass.
Brooklyn. See Johns-Manville, Inc.
Bull-Dog. See Boston Woven Hose & Rubber Co.
Candee. See Ackurate Rubber Co.
Canfield Rubber Co., Bridgeport, Conn.
Canton. See Plymouth Rubber Co.
Clifton. See Clifton Mfg. Co.
Clifton Mfg. Co., 65 Brookside Ave., Boston 30, Mass.
Competition. See New York Insulated Wire Co.
Double-Wear. See Dryden Rubber Co.
Dryden Rubber Co., 1014 S. Kildare Ave., Chicago, Ill.
Dundee, A. & B. See Okonite Co.
Dunton Co., M. W., 670 Eddy St., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Elkhart Rubber Wks., Elkhart, Ind.
Firestone Tire & Rubber Co., Akron, O.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y.
Grimshaw. See New York Insulated Wire Co.
Griptite. See Canfield Rubber Co.
Holfast Rubber Co., Atlanta, Ga.
Holditte. See United States Rubber Co.
Hydro-Proof. See Elkhart Rubber Wks.
Imperial Rubber Co., 220 Broadway, New York N. Y.
Impervo. See Canfield Rubber Co.
Irco. See Imperial Rubber Co.
Johns-Manville Corp., New York, N. Y.
Jomanco. See Johns-Manville, Inc.
Kerite Ins. Wire & Cable Co., 30 Church, New York, N. Y.
Manson. See Okonite Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New York Insulated Wire Co., 114 Liberty, New York, N. Y.
Okonite Co., Passaic, N. J.
O. K. See Appleton Rubber Co.
P. & B. See Ruberoid Co.
Paratex. See Appleton Rubber Co.
Paruco. See Passaic Rubber Co.
Passaic Rubber Co., Clifton, N. J.
Plymouth Rubber Co., 1400 Revere, Canton, Mass.
Red-X. St. Louis Rubber Cement Co.
Relio. See United States Rubber Co.
Ruberoid Co., 95 Madison Ave., New York, N. Y.
S. I. See Superior Insulating Tape Co.
Sitco. See Superior Insulation Tape Co.
Slipknot. See Plymouth Rubber Co.
Star. See Sullivan & Sons Mfg. Co., J.
Sticks. See Graybar Elec. Co.
Stixwell. See Clifton Mfg. Co.
Sullivan & Sons Mfg. Co., J., 2224 N. 9th, Philadelphia, Pa.
Superior Insulating Tape Co., 3044 Lambdin Ave., St. Louis.
2-Plex. See Holfast Rubber Co.
U. S. See United States Rubber Co.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Usco. See United States Rubber Co.
Van Cleef Bros., 7723 Woodlawn Ave., Chicago.
Victor. See Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa

TAPE, Varnished Fabric

Acme Wire Co., New Haven, Conn.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New Jersey Wood Finishing Co., Woodbridge, N. J.

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Radiotape. See Respro, Inc.
Respro, Inc., Wellington Ave. (Auburn), Providence, R. I.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sico. See Standard Insulator Co.
Standard Insulation Co., East Rutherford, N. J.
Voltape. See Respro, Inc.

TAPING MACHINES, Coil

Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Griswold Machine Co., George, New Haven, Conn.
Ridlon Company, Frank, Boston, Mass.
Segur. See Electric Service Supplies Co.

TAPING MACHINES, Wire

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Wire Machinery Corp. of Am., New Haven, Conn.

TAPS. See Stocks, Dies and Reamers.
TENSION DEVICES, Coil Wire. See Racks, Wire Reel.

TENSION MACHINES, Band Wire

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.

TERMINALS AND CONNECTORS

Low Tension, Secondary Terminals and Connectors.

All-in-One. See Ohio Parts Co.
Barcy-Nicholson Co., 2801 Fort, W., Detroit, Mich.
Bassett Metal Goods Co., Derby, Conn. (General Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Burton-Rogers Co., Boston, Mass.
Cabeling. See Jones, Howard B.
Clark Metal Products, 490 Hancock Ave., Bridgeport.
Dixie Supply Co., 91 7th Ave., New York.
Double Grip. See Pons, Eugene
Eagle Elec. Mfg. Co., 50 Hall, Brooklyn, N. Y.
Electron. See Bassett Metal Goods Co.
Fahnestock Elec. Co., East Ave. and 8th, Long Island City, N. Y.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Ideal Clamp Mfg. Co., 198 Bradford, Brooklyn, N. Y.
Jones, Howard B., 2236 Wabansia, Chicago, Ill.
K. E. M. See Keller Elec. Mfg. Co.
Keller Elec. Mfg. Co., 575 Pierrepont Ave., Long Island City.
Morse Co., Frank W., Boston, Mass.
Nu-Way Snap. See Hatheway Mfg. Co.
Ohio Parts Co., 3341 Colerain Ave., Cincinnati, O.
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa.
Patton-MacGuyer Co., Providence, R. I.
Pons, Eugene, 927 Campbell Ave., Schenectady, N. Y.
Petersen Co., 7 Beverly, Providence, R. I.
Rajah Co., Bloomfield, N. J.
Salem Elec'l Supply Co., Salem, Mass.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Shure. See Burton-Rogers Co.
Tinkerbox. See Weber Elec. Wks.
Waterbury Button & Moulding Co., Waterbury, Conn.
Weber Elec. Wks., Brooklyn Sts., Cleveland, O.
Wolverine Tube Co., 1415 Central Ave., Detroit, Mich.
Zierick Machine Wks., F. R., 6 Howard, New York.

TEST BENCHES, Armature

Allen Electric & Equipment Co., Kalamazoo, Michigan.
Burton & Rogers Co., Boston, Mass.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Hobart Bros. Co., Troy, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Mibo Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Pence & Son, H. O., San Luis Obispo, Cal.
Weidenhoff, Joseph, 4352 W. Roosevelt Road, Chicago, Ill.

TESTING INSTRUMENTS. See Instruments.

TESTERS, Coil

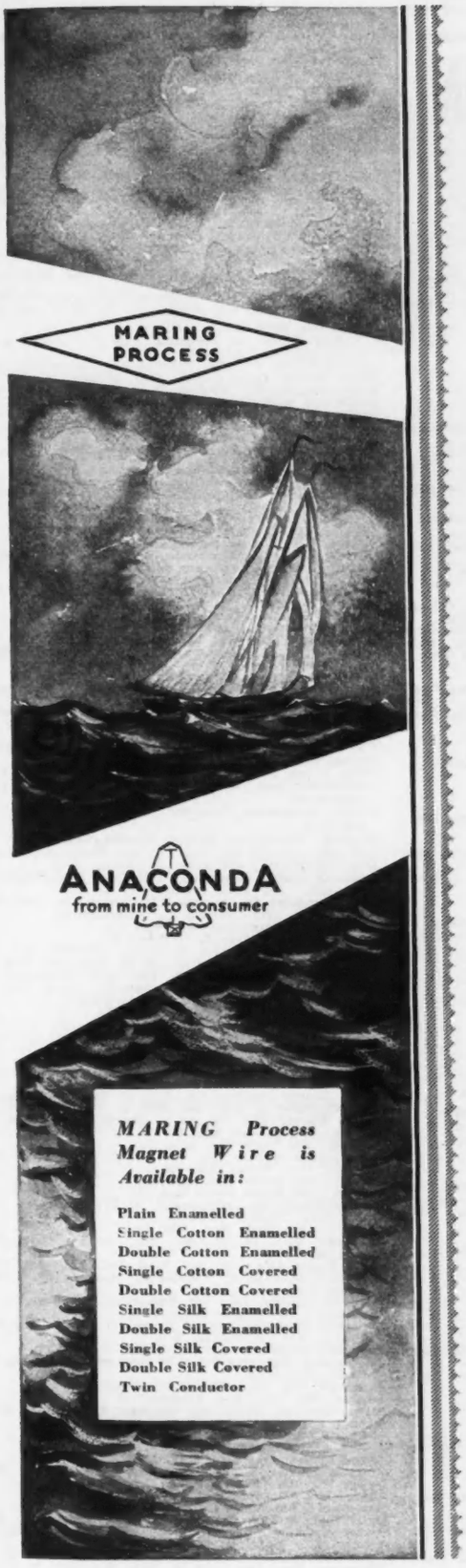
(Includes Armature Growlers, trouble shooters, and other portable testing devices). See also Instruments

Ace. See Weidenhoff, Joseph.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Ankenbrandt, J. J., 2140 Wakeman, Toledo, Ohio.
Armeter. See Chapman Electric Works, P. E.
Bartlett Electric Products Co., Goshen, Ind. (Storage Battery).
Batt-O-Meter. See Indiana Mfg. & Elec. Co., also Case Elec.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Case Elec. Co., Marion, Ind.
Century Electrical Co., 102 Randall Ave., Syracuse, N. Y.
Chapman Elec'l Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Columbia. See Weidenhoff, Joseph.
Comparometer Co., New Ulm, Minn.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Economy. See Weidenhoff, Joseph.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Electrotest. See Comparometer Company.
Elmco. See Electric Machine Corp.
Ev-Ri-Test. See Weidenhoff, Joseph.
Ga-Jit. See General Instrument Corp.
General Instrument Corp., 225 Varick, New York, N. Y.
Herald Elec. Co., 33 East End Ave., New York, N. Y.
Hobart Bros. Co., Troy, Ohio.
Ideal. See Ankenbrandt, J. J.
Indiana Mfg. & Electric Co., Marion, Indiana.
Kietzman Electrical Mfg. Co., 234 N. Central, Gilman, Ill.
Leich Electric Co., Genoa, Ill.
Lundin Electric Machine Co., 10 Thacher, Boston, Mass.
Mallory Electric Co., Factories Bldg., Toledo, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Mibo Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Oman, David W., 43 Royalstone Ave., Minneapolis, Minn.
Paneltest. See Allen Elec. & Equip. Co.
Portometer. See Allen Elec. & Equip. Co.
Portostat. See Allen Elec. & Equip. Co.
Presto. See Metal Specialties Mfg. Co.
Reliable Parts Mfg. Co., Wellington, Ohio.
Rez Batrystat. See Bartlett Products Co.
Scout. See Leich Electric Company.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago, Ill.
Test-All. See Colpin Corp.
Test-O-Meter. See Weidenhoff, Joseph.
Test-Rite. See Colpin Corp.
Victory. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

TESTING LABORATORIES

Baker & Co., Inc., 54 Austin, Newark, N. J.
Elec'l Testing Laboratories, 80th St. and East End Ave., New York, N. Y.
National Elec'l Inst. Co., 162 Sidney, Cambridge, Mass.
New York Testing Laboratories, 80 Washington, New York.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.

THERMO JUNCTIONS. See Instruments, Laboratory Standard.



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Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I.
Improved Seamless Wire Co., 775 Eddy, Providence, R. I.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Venbur. See Coffin Mfg. Co., B. F.
Wilco. See H. A. Wilson Co.
Wilson Co., H. A., Newark, N. J.

THERMOSTATS
American Thermostat Co., 236 Jolliff Ave., Newark, N. J.
Automatic Appliance Co., Jackson, Mich.
Bak-Rite. See Electric Appliance Mfg. Co.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia, Pa.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cobb Elec. Appliance Co., 100 Massachusetts Ave., Boston.
Cramblett Engineering Div. of Time-O-Stat Controls Co., 286 Milwaukee, Milwaukee, Wis.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Diamond H. See Hart Mfg. Co.
Electric Automatic Appliance Co., Denver, Colo.
Electric Heat Control Co., 5002 Carnegie Ave., Cleveland, O.
Electric Maid. See Hankscraft Co.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Frese Thermo-Electric Co., 1296 S. Grove, Irvington, N. J.
Globe Mfg. Co., Battle Creek, Mich.
Hankscraft Co., 615 E. Washington, Madison, Wis.
Hart Mfg. Co., Hartford, Conn.
Hi-Lo. See Boston Machine Wks. Co.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Interstate Products Corp., 29 Commercial, Newark, N. J.
King. See Electric Heat Control Co.
Kitson. See Westinghouse Electric & Mfg. Co.
Manhattan Elect. Supply Co., 510 Sixth Ave., New York.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Moeller, A. E., 261 Sumpter, Brooklyn, N. Y.
Midget. See Coffin Mfg. Co., B. F.
National Steel Construction Co., 425 Fountenac, Seattle, Wash.
Pyratherm. See Federal Gauge Co.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.
Sautilus Devices, Inc., 83 Manhattan, Rochester, N. Y.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Standard Thermometer Co., 48 Shirley, Boston 19, Mass.
Tagliabue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Teeple Co., L. R., 340 E. 9th, Portland, Ore.
Thermolectric. See Bishop & Babcock Sales Co.
Thermosnap. See Spencer Thermostat Co.
Time-O-Stat Controls Co., Elkhart, Ind.
Trent Co., Harold E., 429 N. 12th, Philadelphia, Pa.
Visaflame. See Mercoid Corp.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilcolator Co., Newark, N. J.

TIGHTENERS, Commutator
Elmes Engineering Works, Chas. F., 230 N. Morgan, Chicago, Ill.

TIME SWITCHES. See Switches, Time.

TIN FOIL
Lehmaier, Schwartz & Co., 521 W. 25th, New York, N. Y.
United States Foil Co., 30th & Grand Sts., Louisville, Ky.

TINNING TANKS, WIRE. See Wire Manufacturing Machines.

TINSEL. See Wire, Insulated.

TINSEL, Cord and Thread
Belden Mfg. Co., 2310 B S. Western Ave., Chicago, Ill.
Diamond Braiding Mills, Chicago Heights, Chicago, Ill.
Frank & Co., M. J., 15 W. 39th St., New York, N. Y.
Hy-Sil Mfg. Co., Revere, Mass.
Kilo Co., 2 E. 23rd, New York, N. Y.
Koelle, Frederick C., Real Estate Trust Bldg., Philadelphia.
Lee Mfg. Co., 320 Broadway, New York, N. Y.
Montgomery Co., J. R., Windsor Locks, Conn.
Rochester Products Corp., Nicoll & Canner, New Haven, Ct.
Springfield Wire & Tinsel Co., Springfield, Mass.
Taft Co., R. C., 174 N. Franklin, Chicago, Ill.

TIPS, Cord
Duro. See McEvoy, C. H.
McEvoy, C. H., 430 Broadway, Lowell, Mass.
National Acme Mfg. Co., 7500 Stanton Ave., Cleveland, O.
Norden & Co., S., 180 S. Water, Providence, R. I.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y.
Waterbury Brass Goods Corp., Waterbury, Conn.

TOOLS, Commutator Slotting. See Slotting Machines & Tools, Commutator.

TOOLS, Coil Tamping
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.

TOOLS, Commutator Truing
Acme. See Green Equipment Corp.
Allen Elec. & Equipment Co., N. Pitcher St., Kalamazoo, Mich.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Central Mfg. Co., Fairfield, Ia.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.
Imperial. See Martindale Elec. Co.
Jordan Bros., 74 Beekman, New York, N. Y.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, Ohio.

TOOLS, Storage Battery
Battery Equipment & Supply Co., 7530 Greenwood Ave., Chicago, Ill. Burning Racks, Battery Trucks, Plate Pressers, Mallets, Lead Burners and Strainers.
Battery Parts Co., Inc., Wilkinsburg, Pa. (Leads.)
Battery Tools Co., 29 Willow, Montclair, N. J.
Besco. See Battery Equipment & Supply Co.
Bobbett Elec. Mfg. Co., 811 E. 43rd St., Chicago, Ill. (Knife Heaters.)
Canedy-Otto Mfg. Co., 1816 McGee, Chicago Heights, Ill. (Floor Vises.)
General Elec. Co., Schenectady, N. Y. (Lead Burning Outfits.)
Heet-A-Knife. See Op-al Elec. & Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati. (Terminals.)
Op-al Elec. & Mfg. Co., 1057 E. 30th St., Indianapolis, Ind. (Knife Heaters.)
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa. (Pillar Post Sleeves, Tongs, Reamers, Strap Punches, Terminal Pullers, Steamers, Racks or Stands, Terminal Post Shapers, Battery Analyzer, Post Sealing Machine, Plate Burning Press, Press and Stands.)
Pyratip. See General Elec. Co.
Reliable Parts Mfg. Co., Wellington, O. (Steamer and Still, Filler, Separator Cutter, Clips, Carrier, Post Cutter, Terminal and Cell Puller.)
Thompson Mfg. Co., Meadville, Pa. (Reamers, Terminal Post Pullers, Pressing Tongs.)

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Dreadnaught. See Wall Mfg. Supply Co.
Jim Dandy. See Lasher-Weeber Co.
Klein & Sons, Mathias, Chicago, Ill.
Lasher-Weeber Co., 261 Franklin, Boston, Mass.
McGill Mfg. Co., Valparaiso, Ind.
Peerless. See Lasher-Weeber Co.
Staysanite. See Klein & Sons, Mathias.
TORPEDO Cord. See Twine.

TORSION BALANCES. See Instruments, Laboratory Standard

TRANSFORMERS
Radio. See Radio Circuit Components.
Gas Tube Sign. See Transformers, Oil Burner.
Oil Burner Ignition. See Transformers, Low & Intermediate Voltage.

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Campbell Elec. Mfg. Co., Lynn, Mass.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
K-W Ignition Corp., 2811 Chester Ave., Cleveland, Ohio.
Manhattan Elect. Supply Co., 510 Sixth Ave., New York.
Sorgel Electric Co., 99 W. Water, Milwaukee, Wis.
Standard Transformer Co., Warren, O.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago, Ill.
Uptigraff Mfg. Co., R. E., First National Bank Bldg., Pittsburgh, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Webster Electric Co., Racine, Wis.

TRANSMISSION DRIVES. See Chain, Transmission.

TRANSMITTERS, Power
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Electric Service Supplies Co., 17th & Cambria Sts. Philadelphia, Pa.
Segur. See Electric Service Supplies Co.

TROUBLE FINDERS. See Instruments, Portable and Switchboard; also Testers, Coil.

TRUCKS, Armature. See Lifts, Armature.

TRUCKS, Factory Steel
Angle Steel Stool Co., Plainwell, Mich.

TRUING Devices, Commutator. See Tools, Commutator.

TUBE (Tubes) (Tubing) Adapters. See Radio Receiver Parts
Brass. See Tubing, Brass.
Condenser. See Tubing, Brass and Copper.
Copper. See Tubing, Brass.
Cutters. See Stocks, Dies, etc.
Fibre. See Fibre.
Fibre Candle. See Candles.
Mica. See Mica.
Paper. See Tubes, Paper.
Platinum. See Platinum.
Pyrometer. See Cores, Resistance.
Refractory. See Cores, Resistance.
Radio. See Radio Vacuum Tubes.
Varnished Fabric. See Tubing, Varnished Fabric.

TUBES, Paper; Cores; Sleeves, Bushings
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Climax Tube Co., Mystic, Conn.
Kilmaxcore. See Climax Tube Co.
McCausland, J. E., 86 Valley, Providence, R. I.
Pairpoint Corp., New Bedford, Mass.
Reliable Elec. Co., 3145 Carroll Ave., Chicago, Ill.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa.
Stone Paper Tube Co., 38 O. N. E., Washington, D. C.
Textile Tube Co., Fall River, Mass. (Paper Sleeves.)

TUBING, Brass and Copper
American Brass Co., Waterbury, Conn.
Anaconda. See American Brass Co.
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
Bull Dog. See National Elec. Products Corp.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., T. E., 54 Lafayette, New York
Cook, Dunbar Smith Co., 85 Sprague, Providence, R. I
Dallas Brass & Copper Co., 820 Orleans, Chicago, Ill.
French Mfg. Co., 128 Robbins, Waterbury, Conn.
Michigan Copper & Brass Co., 5851 W. Jefferson Ave., Detroit, Mich.
Mueller Brass Co., Port Huron, Mich.
National Copper & Smelting Co., 1395 Coltman Rd., Cleveland, O.
National Elec. Products Corp., Pittsburgh, Pa.
Randolph Clowes Co., Waterbury, Conn.
Relleum. See Mueller Brass Co.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Rome Brass & Copper Co., Rome, N. Y.
Rome Hollow Wire & Tube Co., Rome, N. Y.
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Torrington Mfg. Co., Torrington, Conn.
United Wire & Supply Co., 1497 Elmwood Ave., Providence.
Wells Co., A. H., Watertown Ave., Waterbury, Conn.
Wolverine Tube Co., 1415 Central Ave., Detroit, Mich.

TUBING, Flexible Metallic
(Flexible Tubing.)
Almond Mfg. Co., T. R., Ashburnham, Mass.
American Metal Hose Co., Waterbury, Conn.
American Metal Moulding Co., 140 Cort St., Irvington, N. J.
Anaconda Wire & Cable Co., 25 Broadway, New York, N. Y.
Auto-Brassflex. See National Metal Elec. Products Corp.
Auto-Steelflex. See National Metal Elec. Products Corp.
Breese Corp., Inc., 84 S. 6th, Newark, N. J.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa.
Ritflex. See United Metal Hose Co.
Sleeper & Hartley, Inc., Worcester, Mass.
Time-O-Stat Controls Co., Elkhart, Ind.
Titeflex Metal Hose Co., Newark, N. J.
Triangle Conduit Co., Dry Harbor Rd. and Cooper Ave., Brooklyn, N. Y.
United Metal Hose Co., 724 Garrison Ave., New York, N. Y.
White Dental Mfg. Co., S. S., 152 W. 42nd, New York.

TUBING, Rubber
Rubber Tubing for Insulating Wire in Instruments and Telegraph Signal Lines.
Canfield Rubber Co., 702 Railroad Ave., Bridgeport, Conn.
Elsler Electric Corp., 756 S. 13th, Newark, N. J.
Faultless Rubber Co., Ashland, O.
Forest City Rubber Co., 1276 Ontario, Cleveland, O.
Goodrich Rubber Co., B. F., Akron, O.
Rubber-Vac. See Elsler Electric Corp.
Tyler Rubber Co., Andover, Mass.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N.

TUBING, Varnished Fabric
Insulating Tubing—Spaghetti.
Acme Wire Co., New Haven, Conn.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Bentley-Harris Mfg. Co., Conshohocken, Pa.
Brand & Co., William, 268 Fourth Ave., New York, N. Y.
Empire. See Mica Insulator Co.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Insulated Duct & Cable Co., Stokes, Trenton, N. J.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
Irvington Varnish & Insulator Co., Irvington, N. J.
Lee Tire & Rubber Co., Conshohocken, Pa.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., B. T., Covington, Ky. (Insulated Waxed Cotton.)
Turbo. See Brand & Co.
Varflex Corp., Rome, N. Y.

TURNED-UP BOXES AND CABINETS. See Cabinets, Sheet Steel.

TURNING TOOLS, COMMUTATOR. See Tools, Commutator Truing.

TWINE, Armature Winding; Torpedo Cord
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Winne & Son, Frank W., 42 N. Front, Philadelphia, Pa.

UNDERCUTTERS, Mica. See Slotting Machines & Tools, Commutator.

UNITS, Refrigerator Condenser. See Condenser Units, Refrigerator.

UNITS, Rods and Grids, Resistance
Acme Elec. Heating Co., Dept. R, 1217 Washington, Boston.
Allen-Bradley Co., 494 Reed, Milwaukee, Wis.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa.
Bradleyunit. See Allen Bradley Co.
Buffalo Products Co., Broome & Lafayette Sts., New York.
Burger, J. P., 1813 Columbus Rd., Cleveland, O.
Calred. See Edison Elec. Appliance Co.
Chromalox. See Edwin L. Wiegand Co.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Crown Coloring & Chemical Co., 33 W. 17th, New York.
Cutler-Hammer, Inc., 1258 St. Paul Ave., Milwaukee.
Dalton Elec. Heating Co., 287 Bridge St., Salem, Mass.
Dalton-Marsh Co., 88 Holten, Danvers, Mass.
Darie Co., 35 E. 21st, New York, N. Y.
Di-El-Ite. See Wirt Co.
Dixon Crucible Co., Jos., Jersey City, N. J.
Dur-ristor. See Cutler-Hammer, Inc.
Eagle Elec. Mfg. Co., 55 Hall, Brooklyn, N. Y.
Edgerest. See Industrial Controller Div.
Edgewound. See Monitor Controller Co.
Edison Electric Appliance Co., 5600 W. Taylor, Chicago, Ill.
Elec. Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electro Thermal-Unit Co., 44 N. Fourth, Philadelphia, Pa.
Elemite. See Louthan Mfg. Co.
Fits-All. See Eagle Elec. Mfg. Co.
Fitz-All. See Rodale Mfg. Co.
Fitz-Rite. See Rodale Mfg. Co.
Fix-All. See Witlow Elec. Mfg. Co.
F & M. See Hiram Marks Elec. Co.
General Electric Co., Schenectady, N. Y.
Globar Corp., Niagara Falls, N. Y.
Glo-Well. See Eagle Elec. Mfg. Co.
Gold Seal Elect. Co. of Ohio, Inc., 250 Park Ave., New York, N. Y.
Hance-Parker Mfg. Co., 397 West Main, Meriden, Conn.
Hankscraft Co., 615 E. Washington, Madison, Wis. (Oven Heater Unit.)
Hardwick, Hindle, Inc., 122 Greenwich, New York, N. Y.
Hexwound. See Monitor Controller Co.
Industrial Controller Div. of Square D Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Industrial Heater Co., 300 Canal, New York, N. Y.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa. (Radio Resistance.)
Krischer's Mfg. Co., 255 Calyer, Brooklyn.
Louthan Mfg. Co., East Liverpool, O.
Marks, Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.
Monitor Edgewound. See Clark Controller Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Nelco. See Nelson Electric Co.
Nelson Electric Co., Plant City, Fla.
Northern Electric Co., 2833 N. Western Ave., Chicago, Ill.
Ogden Mfg. Co., 3947 Armitage Ave., Chicago, Ill.
Ohmite Mfg. Co., 636 N. Albany Ave., Chicago, Ill.
Ohm-Spun. See States Co.
Op-al Elec. & Mfg. Co., 1057 W. 30th, Indianapolis, Ind.
Parker & Co., J. C., 407 Bulletin Bldg., Philadelphia, Pa.
Poloron Elec. Mfg. Co., 20 Bond, New York, N. Y.
Presto Products Co., 64 University Place, New York, N. Y.
Prometheus Elec. Corp., 358 W. 13th, New York, N. Y.
Pyrox. See Westinghouse Elec. & Mfg. Co.
Reben Elec. Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Renuall. See Ogden Mfg. Co.
Repairall. See Waage Elec. Co.
Replacecall. See Waage Elec. Co.
Rihohm. See Ward Leonard Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
Security Elec. Mfg. Co., 2635 Canton St., Chicago, Ill.
Sepco. See Automatic Electric Heater Co.
Smith & Co., T. C., 2915 Powelton Ave., Philadelphia, Pa.
Smoothwound. See Monitor Controller Co.

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UNITS—Continued
Snoco. See Snow & Co.
Snow & Co., E. W., Rochester, N. Y.
Stupakoff Laboratories, 6627 Hamilton Ave., Pittsburgh, Pa.
Super. See Northern Elec. Co.
United Metal Art Mfg. Co., 295 Wyckoff Ave., Brooklyn, N.Y.
Vitrohm. See Ward Leonard Elec. Co.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago.
Ward Leonard Elec. Co., 31 South, Mt. Vernon, N. Y.
Warren Elec. Appliance Co., Warren, Pa.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegand Co., Edwin L., 7500 Thomas Blvd., Pittsburgh, Pa.
Wirt Co., 5231 Greene, Philadelphia, Pa.
VACUUM CLEANER BAGS. See Bags, Vacuum Cleaner.
VACUUM DRYING & IMPREGNATING OVENS. See Ovens, Industrial.
VACUUM PUMPS. See Pumps, Vacuum.

VALVES, Electrically Operated

Asco. See Automatic Switch Co.
Automatic Switch Co., 154 Grand, New York.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Crane Co., 836 Michigan Ave., S., Chicago, Ill.
Cutler-Hammer, Inc., 1288 St. Paul Ave., Milwaukee.
Electric-Valve Mfg. Co., 68 Murray, New York, N. Y.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Gas-Gard Co., 375 Main St., E., Rochester, N. Y. (Gas.)
General Electric Co., Schenectady, N. Y.
Golden-Anderson Valve Specialty Co., 1385 Fulton Bldg., Pittsburgh, Pa.
Lunkenheimer Co., Cincinnati, O.
Minneapolis-Honeywell Regulator Co., Fourth Ave. & 28th, Minneapolis, Minn.
Nacco Mfg. Co., 1482 Clara Ave., St. Louis, Mo.
Northside Elec. Co., 4227 Spring Grove Ave., Cincinnati, O.
Reading Steel Casting Co., Bridgeport, Conn.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
St. Louis Motor Valve Co., St. Louis, Mo.
Tagliabue Mfg. Co., C. J., 18-83rd St., Brooklyn, N. Y.
Teeple Co., L. B., 540 E. Ninth, Portland, Ore. (Gas.)
Time-O-Stat Controls Co., Elkhart, Ind.
Victor. See Lunkenheimer Co.
Zeco. See Zisch Engineering Corp.
Zisch Engineering Corp., 39 Avenue L, Newark, N. J. (Gas.)
VARNISH. See Paint, Varnish, Lacquer.
VARNISHED TAPE. See Tape, Varnished Fabric.
VARNISHED TUBING. See Tubing, Varnished Fabric.
VOLT BOXES. See Instruments, Laboratory Standard.
VOLTMETERS. See Instruments.
VULCANITE. See Rubber, Hard.

VULCANIZERS, WIRE INSULATION

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Biggs Boiler Works Co., Akron, Ohio.
WASHERS, FIBRE. See Fibre.

WASHERS, Leather

Michigan Leather Washer Co., 543 E. Fort, Detroit, Mich.

WASHERS, Lock

Keystone. See Positive Lock Washer Co.
National Lock Washer Co., Newark, N. J.
Positive Lock Washer Co., Ave. A & Miller, Newark, N. J.
Shakeproof Lockwasher Co., 2513 N. Keeler Ave., Chicago.
St. Louis Malleable Casting Co., 7701 N. Conduit Ave., St. Louis, Mo.

WASHERS, Metallic

Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Nut Mfg. Co., 2512 Cullerton, Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Massachusetts Machine Shop, Inc., Boston, Mass.
New England Screw Co., Dept. A., 44 Farnsworth, Boston
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Wrought Washer Mfg. Co., 46 S. Bay, Milwaukee, Wis.
WATTMETERS. See Instruments.

WAX AND COMPOUNDS

Wax and Compound, Sealing and Filling.....See W
Junction Box, Potheads, Battery Tops, Bolt Head Holes.
Wax and Compound.....See S
Saturating and Finishing, Braided Wire, Impregnating Fabric and Paper.
Chatterton's Compound.....See C
Ackurate Rubber Co., 25 Beaver, New York, N. Y. W . . . .
Ajax. See Sherwin-Williams Co.
Asphalt Products Co., 6531 S. State, Chicago.. . . S . .
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. C
Biwax Corp., 208 S. La Salle, Chicago, Ill.... W S . .
Black Nego. See Williams Co., F. M.
Bulls-Eye. See Zinsser & Co.
Candy & Co., 35th and Maplewood Ave., Chicago W S . .
Clifton Mfg. Co., 65 Brookside Ave., Boston.... . . . C
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. . . . . W S . .
Dolph Co., John C., 168 Emmet, Newark, N. J. W . . . .
Di Electric Puttie. See Ackurate Rubber Co.
Ever-Protect. See National Cable Compound Co.
Flake White. See Williams Co., F. M.
General Electric Co., Merchandise Dept., Bridgeport, Conn. . . . . W . . .
George Co., P. A., 4153 Bingham Ave., St. Louis. W . . .
Globe Chemical Co., Murray Road & Big 4 R. R. St. Bernard, Cincinnati, O. . . . . W S . .
Goldo Brown. See Williams Co., F. M.
Great Lakes Thread & Yarn Co., Div. of General Cable Corp., 5133 Wesson Ave., Detroit, Mich. . . . . W . . .
Hercules Powder Co., 975 Market, Wilmington, Del. (Wood Rosin) . . . . . S . .
Hexsulate. See Tar Products Corp.

Imco. See Great Lakes Thread & Yarn Co.
India Red Seal. See Williams Co., F. M.
Insulatine Co., 1 Broadway, New York..... W . . .
Knox & Morse Co., 80 Freeport, Boston, Mass..... W S . .
Loverite. See Mitchell-Rand Mfg. Co.
Lime Seal. See Mitchell-Rand Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind. C
Mineralilac Elec. Co., 1045 Washington Blvd., Chicago, Ill. . . . . W . . .
Mitchell-Rand Mfg. Co., 19 Vesey, New York.... W S C
Mule-Hide. See Lehon Co.
National Cable Compound Co., Mitchell, Ind.... W . . .
National Wax Co., 189 W. Madison, Chicago, Ill. . . S . .
Nu-Blac. See Star Porcelain Co.
Par Flexo. See Williams Co., F. M.
Rubberseal. See Mitchell-Rand Mfg. Co.
Rub-Flexo. See Williams Co., F. M.
Seidner & Enequist, Inc., 86 Hausman, Brooklyn, N. Y. . . . . W . . .
Sherwin-Williams Co., Cleveland, O. . . . . W . . C
Standard Varnish Wks., 433 4th Av., New York.. W . . .
Standard Wax & Import Co., 110 E. 42nd, New York, N. Y. . . . . W S . .
Star Porcelain Co., Trenton, N. J. . . . . W . . C
Tacrite. See Seidner & Enequist, Inc.
Tar Products Corp., Providence, R. I.
Tretter & Co., E. T., 576 Johnson Ave., Brooklyn, N. Y. . . . . W S . .
Waverly Oil Wks., 54th and A. V. R. R., Pittsburgh, Pa. . . . . S . .
Williams Co., F. M., 1282 Prospect Ave., Brooklyn, N. Y.
Zinsser & Co., 48 Vesey, New York, N. Y..... W . . .

WEDGE DRIVERS. See Tools, Cummutator.
WELDS, Lamp Lead-in. See Filaments, Incandescent

WELDING AND CUTTING OUTFITS

Electric Arc, Spot, Butt and Seam Metal Welders and Metal Cutting Outfits.
Acme Elec. Welder Co., 1850 W. Fulton, Chicago, Ill.
A. E. F. See American Electric Fusion Corp.
Agnew Electric Welder Co., Milford, Mich.
Allan Mfg. & Welding Co., Inc., 726 Washington, Buffalo
Almanc. See Allan Mfg. & Welding Co., Inc.
Alternare. See Electric Arc Cutting & Welding Co.
American Elec. Fusion Corp., 2610 Diversey Ave., Chicago
Ames Co., 115 Ninth, Brooklyn, N. Y.
Burke Electric Co., Erie, Pa.
Cushing Mfg. Co., 5617 Pacific Blvd., Los Angeles, Cal.
Dwyer Machine Co., Lynn, Mass.
Economy Electric Products Co., 2400 Woodland Ave., Cleveland, O.
Eisler Electric Corp., 756 S. 13th, Newark, N. J.
Electric Arc Cutting & Welding Co., 156 Jelliff Ave., Newark, N. J.
Electric Welding Co. of America, 744 Court, Brooklyn, N. Y.
Electric Welding Machine Co., 1530 Larned, E., Detroit.
Farwest Electric Welder Co., 1107 Northlake Ave., Seattle.
Federal Machine & Welder Co., Dana Ave., Warren, O.
Fleet-Weld. See Lincoln Elec. Co.
Fusion Welding Corp., 10257 Torrence Ave., Chicago.
General Electric Co., Schenectady, N. Y.
General Engrg. & Supply Co., 160 5th Ave., New York, N. Y.
Gibb Welding Machines Co., Bay City, Mich.
Hansen. See Northwestern Mfg. Co.
Hollup Corp., C. H., 3333 W. 48th Place, Chicago, Ill.
Lincoln Electric Co., Coit Rd. and Kirby Ave., Cleveland.
McAdams Co., J. C., New Britain, Conn.
Nigg Engineering Corp., Second St. & Covina Blvd., Covina, Cal.
Northwestern Mfg. Co., 480 Clinton, Milwaukee, Wis.
Owen Elec. Mfg. Co., Fayetteville, N. C.
Plastic Arc. See Wilson Welder & Metal Co.
Pyrotip. See General Elec. Co.
Quasi-Arc., Inc., 11 W. 42nd St., New York, N. Y.
Riverson & Son, Jos. T., 2553 W. 16th, Chicago, Ill.
Sellars Arc Welder Co., 1200 Fourth Ave., Seattle, Wash.
Seneca Electric Welder Corp., 5057 Woodward, Detroit, Mich.
Siemund Wenzel Electric Welding Co., 79 Hancock, Long Island City, N. Y.
Swift Elec. Welder Co., 3567 W. Grand Blvd., Detroit,
Taylor-Winfield Corp., Mahoning Ave., Warren, O.
Thompson Electric Welding Co., Lynn, Mass.
Una Welding & Bonding Co., 1615 Collamer Ave., Cleveland, O.
U. S. L. Battery Corp., Niagara Falls, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metal Co., Hoboken factory, Terminal Bldg., Hoboken, N. J.
Zeus. See Gibb Welding Machine Co.
WHEATSTONE BRIDGES. See Instruments, Laboratory Standard.

WICKS, Lubricating

Brawley, T. R., 279 20th, Brooklyn, N. Y.

WINDERS

Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Coil. See Winding Machines, Armature & Field Coil.
Electromagnet. See Winding Machines, Induction Coil.
Filament. See Machines, Lamp Making.
Induction Coil. See Winding Machines, Induction Coil.
Loop. See Winding Machines, Armature & Field Coil.

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Browning. See Mutual Foundry & Machine Co.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Conran, Frederick M., 107 Colden, Newark, N. J.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Handy. See Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Herald Electric Co., 35 East End Ave., New York, N. Y.
Hunsdorf, Wm., 2056 E. Fourth, Cleveland, O.
Liberty Starter Co., 271 Vinewood Ave., Detroit, Mich.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Mutual Foundry & Machine Co., Atlanta, Ga.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ridlon Co., Frank, 253 A St., Boston, Mass.
Segur. See Electric Service Supplies Co.
Superior. See Armature Coil Equipment Co.

WINDING MACHINES, Induction Coil

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Conran, Frederick M., 107 Colden, Newark, N. J.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Leesona. See Universal Winding Co.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Morris Register Co., 29th & Broadway, Council Bluffs, Iowa.
Radio Production Machinery Co., 213 Centre, New York.
Universal Winding Co., Boston, Mass.
Viking Tool & Machine Co., 747 65th, Brooklyn, N. Y.
Weehawken Engineering Co., 543 Gregory Ave., Weehawken, N. J.
WINDINGS. See Coils, Finished.

WINDOW SHADES, Factory

Athey Co., 6142 West 65th St., Chicago, Ill.
WIRE (Cable) (Cord), Aluminum. See Aluminum.
Copper Clad. See Wire, Copper Clad.
Forms. See Forms, Wire.
Frames. See Forms, Wire.
Fuse. See Fuses and Fuse Wire
Lamp & Tube Filament. See Filaments, Incandescent Lamp.
Molybdenum. See Molybdenum.
Phosphor Bronze. See Phosphor Bronze.
Platinum. See Platinum.
Radio Bus. See Wire, Bare.
Scrapers. See Strippers.
Strippers. See Strippers.
Tungsten. See Filament, Incandescent Lamp.

WIRE, Bare

Armature Banding .....See S
Copper Wire .....See C
Iron Wire .....See S
Phosphor Bronze .....See B
Radio Bus Wire .....See C
Resistance Wire .....See R
Steel Wire .....See S

Acme. See Alloy Metal Wire Co.
Advance. See Driver Harris Wire Co.
Alloy Metal Wire Co., Moore, Pa. . . . . C B . .
American Copper Products Corp., 233 Broadway, New York, N. Y. . . . . C B . .
American Electrical Works (Phillipsdale), Providence, R. I. . . . . C . . .
American Insulated Wire & Cable Co., Div. of General Cable Corp., 854 W. 21st, Chicago.... C . . S
American Steel & Wire Co., 208 S. La Salle.
Anaconda Wire & Cable Co., 25 Broadway, New York, N. Y. . . . . C . . .
Anylite Elec. Co., Fort Wayne, Ind. . . . . C . . .
Ballast. See Gilby Wire Co.
Baltimore Copper Mills (Div. of General Cable Corp.), Baltimore, Md. . . . . C . . .
Bassett Metal Goods Co., Derby, Conn. (General Sales Agent, Hatheway & Co., 16 Hudson, New York, N. Y. . . . . C . . .
Belden Mfg. Co., 2310B S. Western Ave., Chicago C . . S
Beldenite. See Belden Mfg. Co.
Bradford, Kyle & Co., Plymouth, Mass. . . . . B . .
Braidite. See Cornish Wire Co.
Brenvar. See American Insulated Wire & Cable Co.
Bridgeport Brass Co., Bridgeport, Conn. . . . . C . . .
Calido. See Driver Harris Wire Co.
Chromel. See Hoskins Mfg. Co.
Chromia. See Murray-Harris Wire Co.
Climax. See Driver Harris Wire Co.
Comet. See Driver Harris Wire Co.
Comin. See Gilby Wire Co.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I. C . . .
Copel. See Hoskins Mfg. Co.
Copperweld Steel Co., Glassport, Pa. . . . . C . . S
Cornish Wire Co., 30 Church, New York, N. Y.. C . . .
Corwica. See Cornish Wire Co.
Crapo. See Indiana Steel & Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J.. C . . .
Cupren. See Gilby Wire Co.
Darow Mfg. Co., 36 E. 20th, New York, N. Y... C . . .
Detroit Insulated Wire Co., Detroit, Mich..... C . . .
1885. See Chicago Insulated Wire & Mfg. Co.
Driver Harris Wire Co., Harrison, N. J..... . . B . .
Electron. See Bassett Metal Goods Co.
Excellicter. See Branford Elec. Co.
Fullman Mfg. Co., 1309 Jefferson, Latrobe, Pa.. . . . .
Gilby Wire Co., Riverside Ave., Newark, N. J.... B . .
Goldmark Co., James, 83 Warren, New York.. C . . .
Hope Webbing Co., Providence, R. I. (Braided Wire Tape) . . . . . C . . .

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Hoskins Mfg. Co., 4415 Lawton Ave., Detroit, Mich. ..... R ..
Hudson Wire Co., Cohoes, N. Y. ..... C R ..
Ideal. See Driver Harris Wire Co.
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... C .. S
Indiana Steel & Wire Co., Muncie, Ind. .... S
Karma. See Driver Harris Wire Co.
Keystone. See Fullman Mfg. Co.
Lucero. See Driver Harris Wire Co.
Marion Insulated Wire & Rubber Co., Marion, Ind. C .. ..
Monel. See Standard Alloy Wire Co.
National-Harris Wire Co., 195 Verona Ave., Newark, N. J. ..... R ..
Nehring Electrical Works, De Kalb, Ill. ..... C .. ..
Nichrome. See Driver Harris Wire Co.
Novar. See Standard Alloy Wire Co.
Page Steel & Wire Co., Bridgeport, Conn. .... S
Paranite. See Indiana Rubber & Insulated Wire Co.
Peerless. See Alloy Metal Wire Co.
Phillips Wire Co., Div. of General Cable Corp., Pawtucket, R. I. ..... C .. ..
Phono-Electric. See Bridgeport Brass Co.
Premier. See Alloy Metal Wire Co.
Providence Insulated Wire Co., Providence, R. I.. C .. ..
Race. See Ross Wire Co.
Revolute Wire Co., Hastings-on-Hudson, N. Y.... C .. ..
Rice Co., A. H., Pittsfield, Mass. ..... C .. ..
Roebling's Sons Co., John A., Trenton, N. J..... C .. S
Rome Wire Co., Div. of General Cable Co., Rome, N. Y. ..... C .. ..
Ross Wire Co., 69 Bath, Providence, R. I..... C .. ..
Seneca Wire & Mfg. Co., Fostoria, O. .... S
Silerimp. See Valley Narrow Fabric Co.
Silectron. See Standard Alloy Wire Co.
Solar. See Gilby Wire Co.
Sparg Wire Co., J. A., Rome, N. Y. ..... C .. ..
Standard Alloy Wire Co., Elizabeth, N. J. .... R S
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa. ..... C .. ..
Super-Insulated Wire Co., Plymouth, Mass. ..... C .. ..
Superior. See Alloy Metal Wire Co.
Talking Tape. See Hope Webbing Co.
Therlo. See Driver Harris Wire Co.
Tophet. See Gilby Wire Co.
Tru-Lay. See Page Steel & Wire Co.
Valley Narrow Fabric Co., Falls, R. I.
Wheeler Insulated Wire Co., Bridgeport, Conn.. C .. ..

WIRE, Copper Clad

Copperweld Steel Co., Rankin, Pa.
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa.

WIRE SOLDER. See Solder, Bar and Wire.

WIRE DRAWING MACHINES

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American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Sleeper-Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., 70 Franklin, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio.
Wire Machinery Corp. of Am., New Haven, Conn.

WIRE, Insulated

KEY

Annunciator, Office, Bell Wire	See A
Asbestos Covered Heater Cord	See H
Asbestos Covered Magnet Wire	See M
Enameled Magnet Wire	See M
Fixture Wire	See R
Flexible Reinforced Heavy Duty Cord	See F
Heater Cord	See H
Ignition Cable	See R
Lamp Cord	See R
Magnet Wire	See M
Rubber Covered Wire & Cable	See R
Stove Wire	See H
Telephone Cord	See T

A-A Wire Co. (Div. of General Cable Corp), 420 Lexington Ave., N. Y. C.. R .. ..
A-1 Brand. See American Insulated.
Acme Wire Co., New Haven, Conn.
Enamaled Silk, Cotton .... M
Amelectric. See American Elec.
American Braiding Co., Holyoke, Mass. R .. ..
American Brand. See American Insulated Wire & Cable Co.
American Copper Products Corp., 233 Broadway, New York, N. Y. ....
American Electrical Works (Philipsdale), Providence, R. I. .... M
American Enameled Magnet Wire Co., Muskegon, Mich. .... M
American Insulated Wire & Cable Co. Div. of General Cable Co., 954 W. 21st, Chicago, Ill. .... M
American Insulated Wire Corp., Div. of General Cable Co., 45 Baker, Providence, R. I. ..... R F .. A T ..
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... R F H A T M
Americore. See American Steel.
Amerite. See American Steel.
Amerixe. See American Steel.
Amparak. See American Steel.
Anaconda Wire & Cable Co., 25 Broadway, New York, N. Y. ..... R W .. A .. M
Anaconda Wire & Cable Co., Pawtucket, R. I. ..... R F .. ..
Anaconda Wire & Cable Co., Maring Wire Branch, Muskegon, Mich. (Silk, Enamel) .. .. M
Ansonia Electrical Co., Ansonia, Conn.
Silkx, Cotton, Enameled .... A .. M
Armoriokt. See American Steel.
Bay State Insulated Wire & Cable Co., Paydras (Mattapan), 26, Boston..... R .. ..
Chicago, Ill. ..... R F H A T M
Belden Mfg. Co., 2310B S. Western Ave.,
Beldenamel. See Belden Mfg. Co.
Beldenite. See Belden Mfg. Co.
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. ..... R F .. ..
Boston Insulated Wire & Cable Co., 65 Bay, Boston, Mass. ..... R F H .. .. ..
Bradford, Kyle & Co., Plymouth, Mass. .. .. M
Cablex. See Collyer Insulated Wire Co.
Celatsite. See Acme Wire Co.
Collyer Insulated Wire Co., Pawtucket, R. I. ..... R F H .. .. ..
Colorbeston. See General Elec. Co.
Condex. See Simplex Wire Co.
Colorubber. See Belden Mfg. Co.

Copperweld Steel Co., Rankin, Pa..... R .. .. .. T ..
Cotenamel. See Belden Mfg. Co.
Cottonite. See Acme Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J. ..... R F H A T M
Darow Mfg. Co., 36 E. 20th, New York. R .. ..
Davis-Jones Insulated Wire Co., Pawtucket, R. I. ..... R F H A T ..
Deltabeston. See York Insulated.
Detroit Insulated Wire Co., Detroit, Mich. R .. .. .. T ..
Diamond Braiding Mills, Chicago Heights R F H .. .. M
Di-Noburn. See Diamond Braiding Mill.
Dreadnaught. See Indiana Rubber Co.
Driver-Harris Co., Harrison, N. J..... R .. H .. .. ..
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.. .. .. M
Ducatto. See Anaconda Wire & Cable Co.
Durabilt. See Anaconda Wire & Cable Co.
Duracord. See Anaconda Wire & Cable Co.
Durawire. See Anaconda Wire & Cable Co.
Duro. See McElroy, C. H.
Eagle. See Goldmark Co., James.
Eastern Insulated Wire Co., Tilton, N. H. R .. ..
1885. See Chicago Insulated Wire.
Enamelite. See Acme Wire Co.
Fibrex. See Simplex Wire Co.
Flexible Woven Cable Co., 755 Boylston, Boston, Mass. .... F .. ..
Flex-O-Cord. See Packard Elec. Co.
Garco. See General Asbestos Co.
Gavitt Mfg. Co., West Brookfield, Mass. .. .. T ..
GE-Flex. See General Elec. Co.
General Asbestos & Rubber Co., Charleston, S. C. .... H .. .. ..
General Elec. Co., Merchandise Dept., Bridgeport, Conn.... R F H .. .. M
Giant. See Collyer Insulated Wire.
Goldmark Co., James, 811 Warren, New York, Annunciator and Asbestos, Cotton, Silk and Enameled Magnet .... A .. M
Goodyear Rubber Insulating. See Graybar Electric Co.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y. R .. .. .. T ..
Grimshaw. See New York Ins.
Hatex. See Hatfield Rubber Wks.
Hatfield Rubber Wks., Inc., Hillside, N. J. ..... R F H .. T ..
Hazacord. See Hazard Insulated Wire Works.
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.... R F .. A .. ..
Holyoke Co., 621 Broadway, New York.. R .. .. A .. M
Inca Mfg. Co., Fort Wayne, Ind..... .. .. M
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... R F H .. .. ..
I. X. L. See Collyer Insulated.
Kable. See Safety Cable Co.
Kenrite. See American Insulated.
Kerite Ins. Wire Cable Co., 30 Church, New York, N. Y. ..... R .. ..
Kilo. Co., 2 E. 23d, New York..... .. .. T M
Koelle, Frederick C., Real Estate Trust Bldg., Philadelphia, Pa. .... T ..
Lowell Insulated Wire Co., Lowell, Mass. R F H .. .. ..
Liberty. See Nat. Metal Molding
Loxsteel. See Hazard Insulated Wire Works.
McElroy, C. H., Lowell, Mass. ..... R .. .. .. T ..
Marion Insulated Wire & Rubber Co., Marion, Ind. ..... R F H A T ..
Massachusetts Elec. Mfg. Co., West Lynn, Mass. .... M
Montgomery Co., J. R., Windsor Locks, Conn. .... T ..
National Elec. Products Corp., Pittsburgh, Pa. ..... R F H A T M
N. E. See Goldmark Co., James
New York Insulated Wire Co., 114 Liberty, New York, N. Y. ..... R .. ..
Nitro. See Belden Mfg. Co.
O. K. See Phillips Wire Co. Also
Okocord. See Okonite Co.
Okonite Co., Passaic, N. J. ..... R .. ..
Ozex. See Simplex Insulated Wire
Packard Electric Co., Warren, O ..... R F .. ..
Parac. See Phillips Wire Co.
Paracore. See U. S. Rubber Co.
Paraflex. See Bishop Wire & Cable.
Paranite. See Indiana Rubber.
Parkerite. See Seward Wire Co.
Peco. See Packard Elec. Co.
Philadelphia Insulated Wire Co., 200 N. Third, Philadelphia, Pa. .... H A T ..
Phillips Wire Co., Div. of General Cable Corp., Pawtucket, R. I. ..... R .. ..
Providence Insulated Wire Co., Providence R F H A .. ..
Raven Core. See New York.
Reliance. See American Steel.
Rochbestos Products Corp., Nicoll & Conner Sts., New Haven, Conn. ..... R .. H .. T M
Roebling's Sons Co., John A., Trenton, N. J. ..... R F H A T M
Rome Electrical Co., Inc., Div. of General Cable Corp., Rome, N. Y. .... M
Rome Wire Co., Rome, N. Y. ..... R F H .. T M
Ross Wire Co., 69 Bath, Providence, R. I.. R .. ..
Runzel-Lenz Elec. Mfg. Co., 1751 N. Western Ave., Chicago, Ill. .... T ..
Safety Cable Co. (Div. of General Cable Corp.), New York ..... R F H .. .. ..
Salamander. See York Insulated.
Seward Wire Co., Parkersburg, W. Va. R .. ..
Silkenamel. See Belden Mfg. Co.
Silkenite. See Acme Wire Co.
Simcore. See Simplex Wire.
Simplex Wire & Cable Co., 63 Sydney, Cambridge, Mass. ..... R F .. ..
Shield. See Ansonia Elec'l Co.
Southern States Cable Co., Div. of General Cable Corp., Mobile, Ala..... .. .. M
Spiralweave. See Hazard Ins. Wire
Standard Alloy Wire Co., Elizabeth, N. J. .. .. H .. .. ..
Standard Underground Cable Co., Pittsburgh, Pa. (Div. of General Cable.) R F H A T ..
Sterling. See Standard Underground.
Sterling Insulated Wire Co., Fall River, Mass. ..... R .. ..
Strand & Sweet Mfg. Co., Winsted, Conn. .. .. M
Super-Service. See Rome Wire Co.
Sweetstrand. See Strand & Sweet.
Tip-Top. See Standard Underground.
Tirex. See Simplex Wire & Cable.
Trenchlay. See Rome Wire Co.
Triangle Conduit Co., Dry Harbor Rd. & Cooper Ave., Brooklyn..... R .. ..
Tubular Woven Fabric Co., Pawtucket, R. I. ..... R F .. ..
United States Rubber Co., 1790 Broadway, New York, N. Y. ..... R .. H A T ..
U. S. Royal. See United States.
Varflex Corp., Rome, N. Y. .... M

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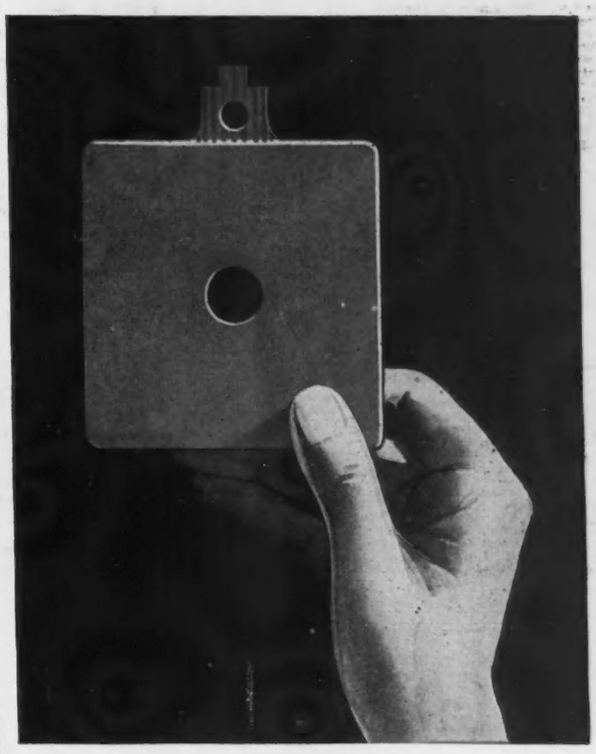

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Whitney Blake Co. See Graybar Electric Co.
Wovenite. See Flexible Woven.
York Insulated Wire Wks. of G. E. Co., 120 Broadway, New York, N. Y. ..... B . . H . . . M

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Braiding Machines ..... See B
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Park Cabling Machines ..... See A
Saturating Tanks ..... See F
Spooling Machines ..... See U
Stranding Machines ..... See S
Tinning Tanks ..... See F
Winding Reels ..... See U

Adamson Machine Co., Akron, Ohio.. I A . . . . . .
Aimco-Seward. See American Insulating Machinery Co.
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa. I A . . . S U F
Breguet. See American Insulating
Crescent. See Royle & Sons, John.
Durant Mfg. Co., 662 Buffum, Milwaukee, Wis. ..... M . . U .
Housatonic Machine & Tool Co., Bridgeport, Conn. ..... I . . . . . U . .
Minneapolis Elec. & Construction Co., 80 S. 12th St., Minneapolis, Minn. . . . . M . . U .
Nebutteo. See New England Butt Co.
New England Butt Co., 324 Pearl, Providence, R. I. ..... I A B M F U .
Peerless. See Royle & Sons, John.

Royle & Sons, John, Paterson, N. J. I . . . . . .
Sleeper & Hartley, Inc., Worcester, Mass. ..... A . . . S U
Terkelsen Machine Co., 226 A St., Boston, Mass. ..... M . . . . .
Textile Machine Works, Reading, Pa. . . . . B . . . . .
Universal Wire Machy. Co., 69 Daggett, New Haven, Conn. ..... A . . . . . U I
Utility Mfg. Co., Cudahy, Wis. ..... I . . . . . .
Wardwell Braiding Machine Co., Central Falls, R. I. ..... B . . . . . .
Wire Machinery Corp. of Am., New Haven, Conn. ..... M S U .
Weir. See Housatonic Machine

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New England Butt Co., 324 Pearl, Providence, R. I.

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Roebling's Sons Co., John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.

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Shuster Co., F. B., New Haven, Conn.

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WIRE VULCANIZING MACHINES. See Vulcanizers Wire Insulation.

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WOOD BLOCKS. See Cabinets & Boxes, Wood.
Boxes. See Cabinets & Boxes, Wood
Cabinets. See Cabinets & Boxes, Wood
Pulleys. See Pulleys, Composition.
Woods Metal. See Radio Mountings.

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Commercial Rayon & Thread Co., 19 W. 21st, New York N. Y.
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Fiorsheim, H. A., 225 Fifth Ave., New York, N. Y
Franklin Rayon Corp., 86 Crary, Providence, R. I.
General Electric Co., Schenectady, N. Y.
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Keasbey & Mattison, Ambler, Pa.
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Ryle & Co., Wm., 381 Fourth Ave., New York, N
Silkslip. See Worcester Bleach & Dye Wks. Co.
Smith & Dove Mfg. Co., Andover, Mass. (Linen Thread.)
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Lind Mfg. Co., 70 Wyckoff Ave., Brooklyn, N.Y. (Zinc Cups
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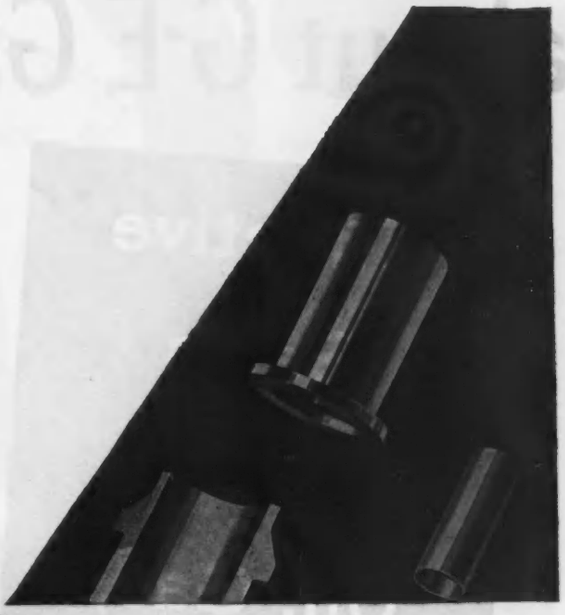

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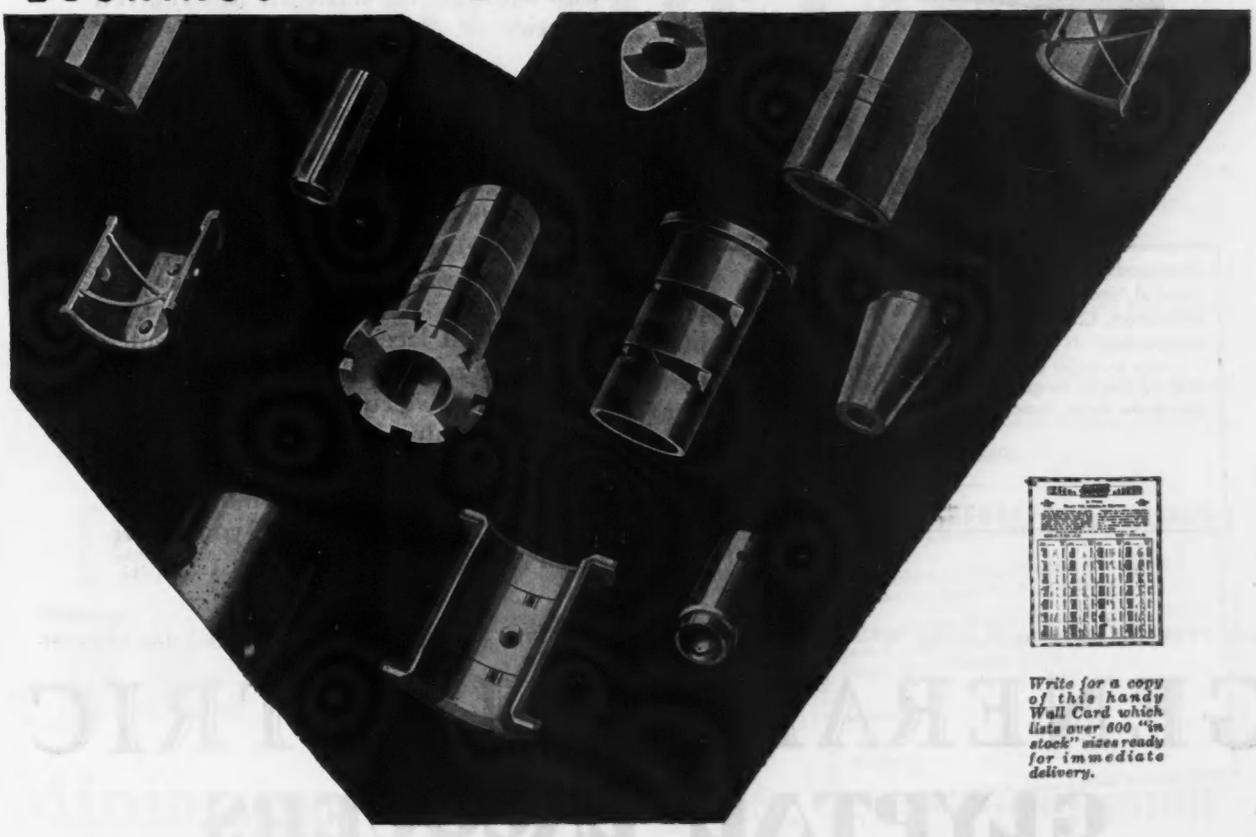

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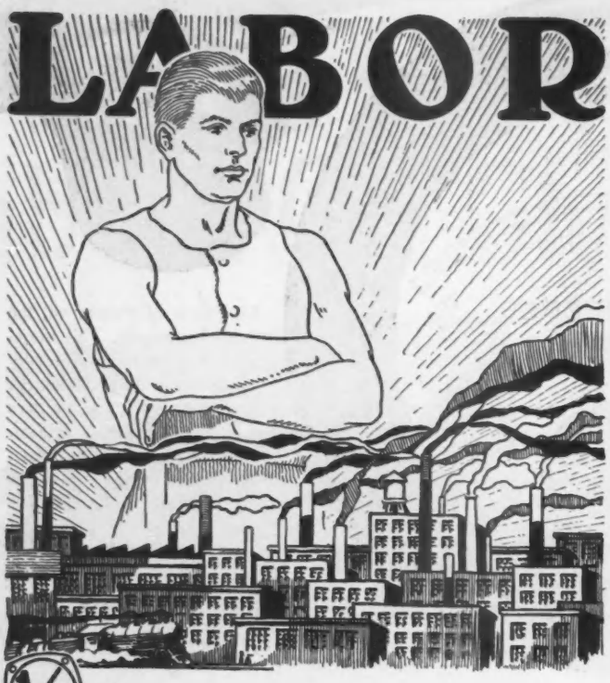

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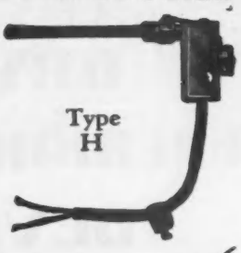

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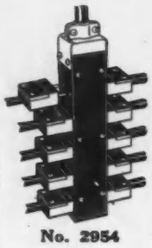

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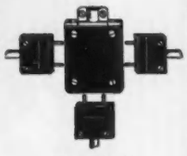

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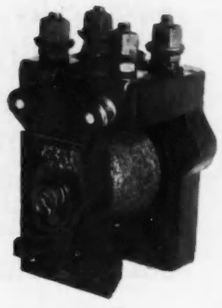

12-50 V.	30 Amp.
115 V.	30 Amp.
230 V.	15 Amp.

Alternating Current
2¼" wide—3¼" high

A single pole double break relay for mounting conditions where maximum capacity is desired in a limited space. Common or separate coil control.

A complete service on relay problems is yours for the asking. Write us.

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Newark New Jersey

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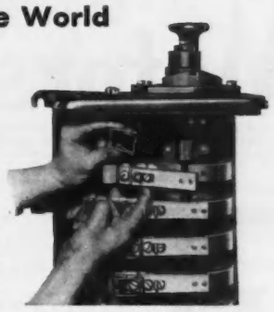
The Most Complete Line of Drum Controllers in the World

HERCULES Drum Fingers

No Better Drum Fingers Made

The Union HERCULES drum finger is the result of over twelve years' experience in the designing and manufacturing of drum controllers and drum fingers, and represents the very latest in design. Every desirable feature is obtained in this finger construction.

For complete details see our Publication 500



A view showing the simplicity of removing the contact pressure spring for inspection of the contact tips. No tools are required for this operation.

UNION ELECTRIC MFG. CO.
934 Juneau Avenue Milwaukee, Wis.
Manufacturers of
Electric Motor Control Apparatus

Also Associated Manufacturer with, and Eastern Distributor for
DIAMOND E ELECTRICAL MFG. CO., *Los Angeles, Cal.*
Magnetic Motor Control Apparatus

220, 440 or 550 Volts Easily changed to 110 Volts

or any other voltage, with SORGEL Air-Cooled

TRANSFORMERS

With Conduit Connections

No extra fittings required

Can be installed in any convenient place inside of buildings, without enclosures or fire-proof vaults.

Approved by Underwriters.

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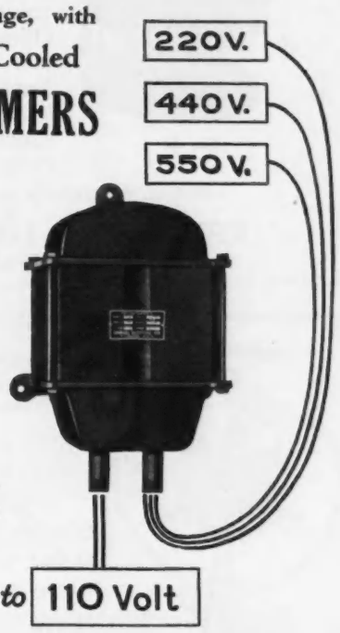
1/4 to 50 KVA.
Single - phase, 2 - phase and 3 - phase

Transformers designed for special applications

Ask for descriptive literature



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INSPECTION *the cue to quality*

3¼" diameter A.C. panel type.

YOUR PRODUCTS must earn the right to markets which each year are becoming more critical of QUALITY. Checking the manufacture of the product, step by step, with frequent inspections is not only the cue to quality, but the best means of accelerating production, improving deliveries and keeping pace with sales demand.

Manufacturers of radio receivers, tubes and other electrical equipment have told our representatives without reservation that they could not possibly maintain the speed necessary to meet production schedules without the unstinted use of Weston Instruments —particularly the 3¼" diameter panel models which can be employed for the majority of electrical inspection tests.

3¼" diameter Thermo-Couple type.

The unusual electrical characteristics, speed of measurement and dependability of these instruments for bench testing work, their adaptability to every type of service both for panel mounting and portable testing sets, coupled with their low cost, easily make them the outstanding choice.

Many manufacturers carry stocks of selected ranges constantly on hand, both for mounting on their products and for maintenance and inspection testing. Communicate with our nearest sales office for full particulars, ranges and prices.

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PIONEERS SINCE 1888
INSTRUMENTS

ACCURACY—

is guaranteed for Hardwick-Hindle resistors,—*especially when made* according to the manufacturer's specifications—and

SPEED—

is the keynote of our factory—72 hours after the specifications *come*, the samples *go* on the way to our client.

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IT'S jammed full of charts—engineering data that every engineer would be glad to have on hand when ordering resistors. It also gives a complete listing of the Hardwick, Hindle line—with types of brackets, lugs, etc. Merely send us your request for a copy on your business letterhead—the catalog is free.

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INCORPORATED
SALES DEPT.
122 Greenwich St., New York City
Factory
215 Emmet Street, Newark, N. J.

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MANUFACTURERS OF ELECTRICAL PRODUCTS
SIGNAL
Motors

Universal and induction type small fractional horsepower motors to meet all requirements for small motors. Send us your specifications. SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan
Small Motor Specialists Since 1890.

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RHEOSTATS

UNEQUALED: BUT COST NO MORE

Adjustable Resistance At Its Best
SMALL IN SIZE
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LONG IN LIFE

FINE CONTROL

MOTOR SPEED CONTROLLERS
LABORATORY RHEOSTATS
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Universal Motor for 110 Volts

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Battery motors and small generators our specialty. Send for circular.

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⅛ to 2 H.P.

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N. A. STRAND & COMPANY, 5001 N. Lincoln St., Chicago, Ill.

Fifteen ampere dial and pointer control

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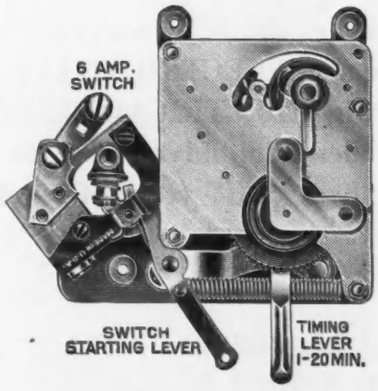
Automatic Timers

—for cookers, ranges, electrotherapy, vulcanizers, motors, permanent wavers and hundreds of other devices wherein the current is to be automatically controlled.

IN WALSER Automatic Timers the interval timing operation is positively fool-proof. There can be no question as to the movement starting when the switch is turned on and the clock set for operating.

If you have a problem calling for accurate interval timing operation, WALSER has the answer waiting your inquiry.

No. 660H



Six ampere lever control

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On every heavy installation . . . .

SHERMAN HEAVY DUTY SOLDERING LUGS

The one complete, standard, accurate line—*by the world's largest maker of electrical connectors.*

Every large soldered connection in your plant, whether it be on a motor, generator, dynamo, switchboard, panelboard, or transformer, should be equipped with a SHERMAN heavy duty lug. Uniform accuracy—these lugs were the first to be made in accordance with the N.E.L.A. Committee's specifications. Well made—no burr, *flat* contact surfaces, and made only from the best seamless copper tubing. All sizes and types.

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Sold thru Jobbers

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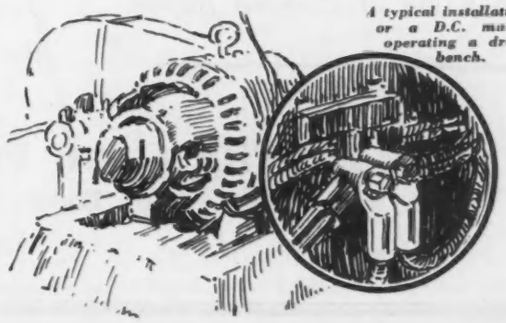

A typical installation or a D.C. motor operating a draw bench.

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has the largest *sustained* reader-buyer circulation in the electrical business press ★

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No. 10 Alloy possesses higher arc-resisting qualities than the various grades of silver used in contact points, and compares, size for size, very favorably in price.

No. 10 Alloy is much more economical than tungsten in the many contact point applications where tungsten is replaceable.

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A grade for every need

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We make these and other resistance alloys in wire, ribbon or strip, either bare or insulated.

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A NEW combination of metals perfected to avoid the necessity of extra processing when contact with steam or water makes the use of other thermostatic metals impractical. Little loss of sensitivity. Made in all sizes and shapes for every application.

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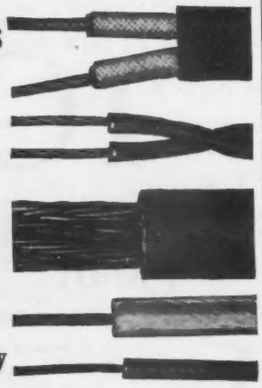
OUR
Insulated Wire Strippers
—A Big Help
At Low Cost—



We specialize on equipment for removing insulation from any conductor as required for any electrical connection.

One of our motor driven tools will save you time, money and trouble, and improve quality of work. Let us suggest the best equipment for your job. Descriptive bulletin and low prices mailed on request.

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We specialize in commutators for high speed motors.

Let us estimate on your requirements
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For Screw Driving and Nut Setting

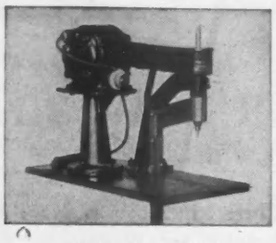
in your production work and double your output. We manufacture several types—Portable and Bench Machines.

Send us your particular proposition.

These tools are adaptable for Radio and Speaker assembling, also electric plugs, switches, etc.

Will handle screws up to No. 10.

Ask us for prices and circular matter.



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A HANDY TOOL
for all
MANUFACTURERS

Here is a tool that will save you time and money, speed up production and lower your costs.

This inexpensive tool strips wire of 10 to 20 gauge 20 times faster than usual methods. Give it a trial on a money back guarantee. Thousands in use.

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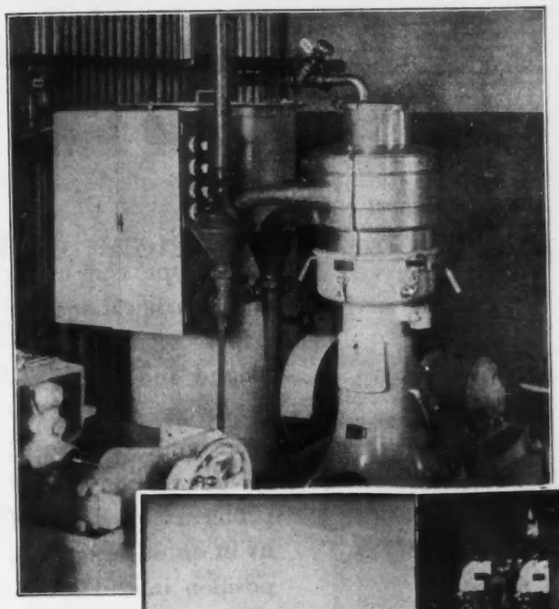

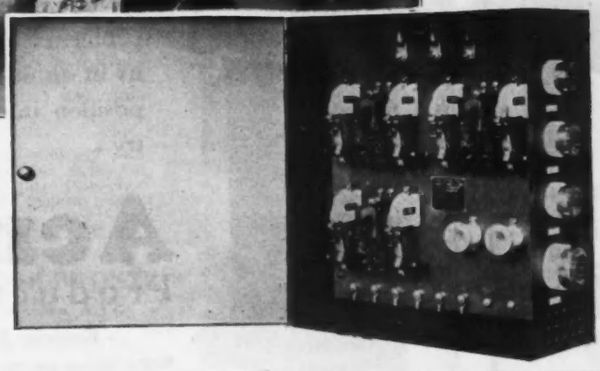

Specify SUNDH *Control for* A.C. *or* D.C.

The electric control for this heavy-duty oil preheater had to be fully automatic

Here is another instance of where a difficult electrical control problem was definitely solved by putting it up to SUNDH. A prominent power company wanted an electric control for the automatic operation of an electric oil preheater in one of its sub stations. The oil had to be preheated to the *correct* temperature before it was sent through the centrifugal oil separator for purification.

This power company's consultants laid the problem before SUNDH engineers and the solution was *final,* as usual

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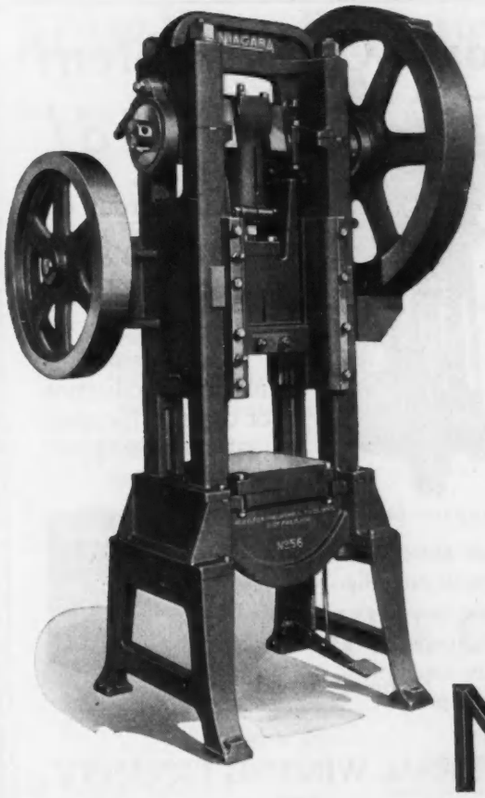

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4-Piece Tie Rod Construction

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Nos. 54 and 56 combine unusual rigidity and strength, due to shrunk-tie-rod construction. Can be furnished plain or single back geared, in belt or motor driven types. 32 and 56 tonnage pressure. Correct bed heights and plenty of leg room for the operator.

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Write for Bulletin 63 or describe your problem and let our engineers recommend.

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DEPENDABILITY of springs as a part of your product is of more importance to you than initial cost. All things considered, when a spring is essential to the operation of any device the best is the cheapest, regardless of first cost.

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ANY MATERIAL OR QUANTITY
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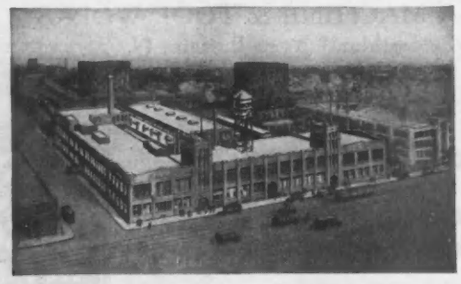

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Lesson
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Phosphor *Bronze*

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Elephant Brand can be bought in ingots, castings, rods, tubes, sheets, wire and ropes. The S Bearing Metal is unequalled in Bearing qualities and uniformity, and is typical of the line.

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All Products Made to Recognized Commercial Standards including those of:
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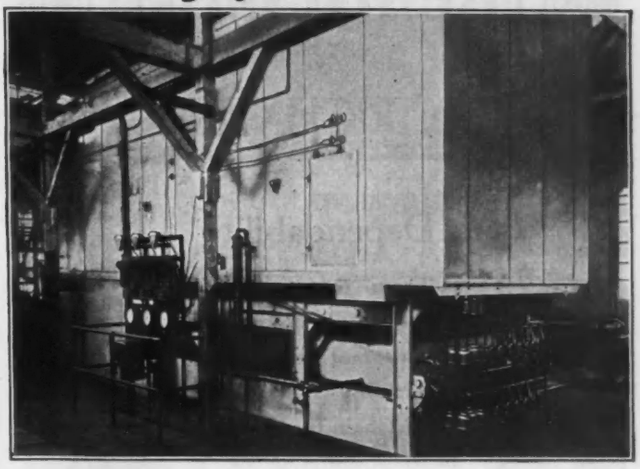

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THIS electrically heated insulation baking oven is one of the important factors in the economical production of a line of fractional horsepower electric motors nationally known for their efficiency and durability.

The rotors and stators are hung on the conveyor which automatically carries them through a pre-heating chamber where they are thoroughly dried; then through the automatic dip where the insulating varnish is applied. Emerging from the varnish they are allowed to drain and then carried through the baking chamber where the varnish is thoroughly solidified without embrittlement. Passing through a cooling compartment the finished product is removed from the conveyor at the loading station.

1200 rotors and stators per day are treated in this way.

Write for Bulletin 27 E, Ovens for the Electrical Industry.

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Drying.
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Adapted to all methods of heating.

INDUSTRIAL OVENS

BEAD CHAIN *for* ELECTRIC FIXTURES

Dependability

From the standpoint of quality, uniformity, and prompt delivery, dependability has made Bead Chain the standard of the industry.

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"Everything in Insulation"

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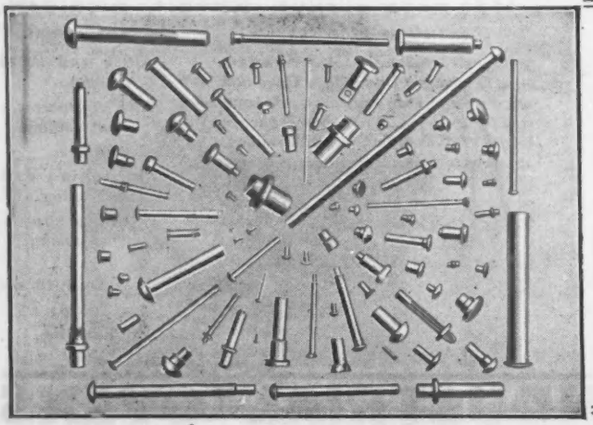

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MACHINE SCREWS
MACHINE SCREW NUTS
SPECIAL STUDS
SPECIAL SCREWS

COMMUNICATE WITH
THE HOUSE OF SERVICE

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Their experience has probably brought out certain requirements that exist in the buyer's mind. Beauty—colors—novelty—long life—non-crazing—washability—sanitation—or perhaps still more technical specifications. Buyers only reflect the needs of the ultimate consumer, who knows today what he wants! If you believe, as we do, that your sales swing as much on the FINISH of your products as on any other single factor, a heart-to-heart talk with your salesmen may bring you interesting discoveries.

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FOR EVERY INDUSTRIAL PURPOSE

CHICAGO DENVER
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M&W Co. 1876 LACQUERS ENAMELS

IF

You want a dependable Lacquer that is "Custom Built"—

One that has shown a long, Enviable Record of Performance —

One that has been adopted as the "Criterion of Quality"—

At a Fair Price —

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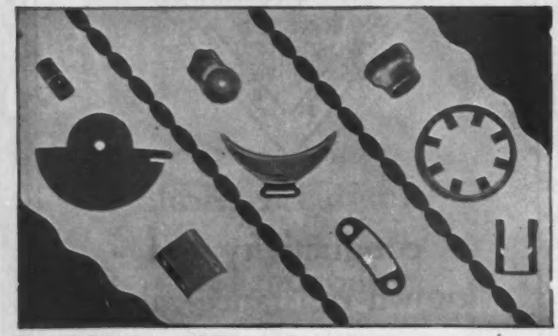

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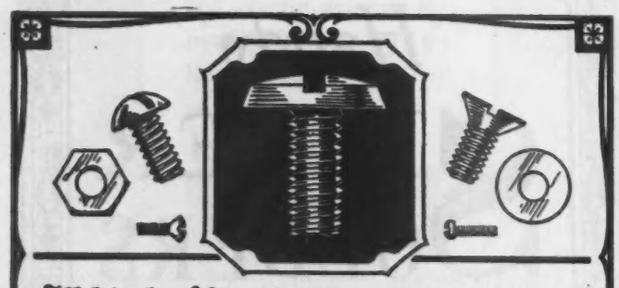

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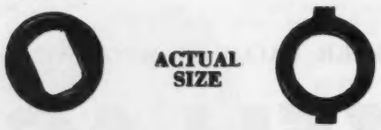

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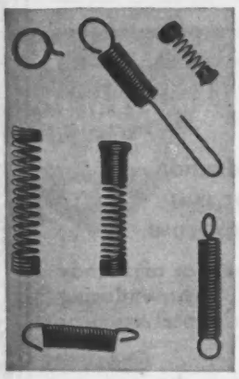

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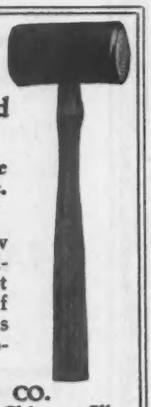

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Replies from our readers to any of these inquiries will be greatly appreciated by the Information Bureau of ELECTRICAL MANUFACTURING, 461 Eighth Avenue, New York City.

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"Reliance Knight" Lamps
"Burrows" Therapeutic Lamp
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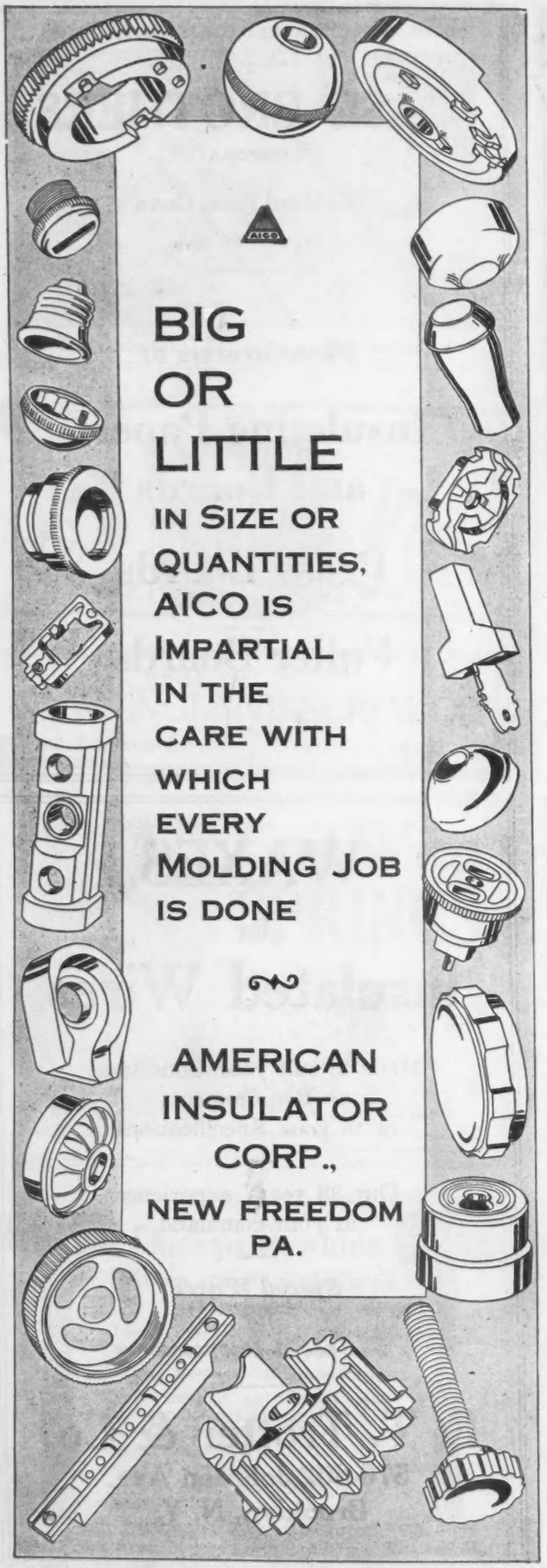
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Index to Advertisers

Acme Products Co.....134
Acme Wire Co., The.....135
Advance Spring & Wire Co.....138
Akron Porcelain Company, The 103
Allen & Hills, Inc..... 94
Ambler Asbestos Shingle & Sheathing Co. 89
American Felt Company..... 95
American Insulator Corporation..140
American Lava Corporation.....107
Anaconda Wire & Cable Co.....113
Angle Steel Stool Co.....120

Badger Die Casting Co..... 84
Bakelite Corporation 87
Baker & Company, Inc..... 98
Barnes Co., The Wallace.....109
Barnhart Brothers and Spindler 81
Baumbach Mfg. Co., E. A..... 81
Bead Chain Mfg. Company, The.136
Becker Brothers Elec'l Corp....132
Beckwith Machine Company, The 124
Belden Mfg. Company
Inside Front Cover
Blake & Johnson Co., The.....120
Bohn Aluminum & Brass Corp. 15
Brand & Company, William....107
Brawley, T. R..... 97
Bryant Elec. Company, The....125
Burgess & Company.....109

Candy & Company, Inc.....136
Case Brothers, Inc.....139
Chace Valve Co., W. M.....112
Chandler Company, The..... 96
Chicago Mica Co.....105
Chicago Rawhide Mfg. Co., The.138
Cochrane Chemical Co.....116
Colonial Insulator Company....107
Connecticut Molded Products Corp. 101
Conran, Fredk. M.....116
Consumers Rubber Co., The.... 88
Cook Pottery Company....92-94-100
Cooke Seal Ring Co.....124

Davis Slate & Mfg. Company..106
Delbee Rubber Co..... 81
Derby Commutator Co., The....132
Deutschmann Corp., Tobe..... 10
Dolph Company, John C..... 96
Driver-Harris Co. 111
Dudlo Manufacturing Co..... 9
Dumore Company, The..... 13
Dunn, Inc., Struthers.....126

Electric Valve Mfg. Company... 86
Electrical Refractories Co., The..105
Electrical Testing Labs.....120
Eureka Metal Prod. Corp.....109

Fair Haven Marble & Marbleized Slate Co. 106
Fibroc Insulation Co.....103
Fischer Spring Co., Chas....108-114
Formica Insulation Co., The.... 4
Franklin Die Casting Corp..... 84
Franklin Fibre Specialty Co.....101

Gage Publishing Co., Inc., The..130
Gair Company, Robert..... 17
Garfield Mfg. Company..... 94
General Electric Company.18-85-122
General Etching & Mfg. Co..... 96
General Plastics, Inc..... 12
Gibson Co., Wm. D.....134
Gilby Wire Company.....116
Gray Brothers, Inc..... 84

Handy & Harman.....137
Hardwick, Hindle, Inc.....128
Hartford City Paper Co..... 97
Hatfield Rubber Co.....117
Highland Elec. Chemical Co....136
Hinde & Dauch Paper Co., The. 6-7
Hunter Pressed Steel Co.....108

Impervious Varnish Co..... 96
Insulation Products Co..... 94
Insuline Corp. of America..... 95
International Insulating Corp... 93
Interstate Products Corp.....132

Jewell Electrical Instrument Co..123
Johnson Bronze Company.....121

Kendrick & Davis Company.....128
Kliegl Bros. 126
Kodel Elec. & Mfg. Co., The...119
Kuhn & Jacob Machine & Tool Co. 101
Kurz-Kasch Co., The..... 97

Leland Electric Co., The.....124
Linden & Company.....104

Maas & Waldstein Co.....137
Mass. Machine Shop, Inc.....138
Master Electric Co., The..... 3
Mercer Porcelain Co., Inc.....100
Mica Insulator Company..... 91
Milwaukee Die Casting Co..... 77
Mitchell-Rand Mfg. Co.....136
Munsell & Co., Eugene.....101

National Electric Controller Co..128
National Vulcanized Fibre Co.. 63
New Departure Mfg. Company, The 73
New England Screw Co.....138
New Jersey Zinc Co., The
Back Cover
Newton Die Casting Corp., The 75
Niagara Machine & Tool Works.133
Norton Laboratories, Inc..... 94

Ohio Elec. & Controller Co., The.131
Olson Mfg. Company.....104

Parker-Kalon Corp.
Inside Back Cover
Patton-MacGuyer Co. 138
Peck Spring Co., The.....138
Phosphor Bronze Smelting Co., The 135
Platt Bros. & Co., The.....139
Portland-Monson Slate Co.....106
Progressive Manufacturing Co., The 136
Pyramid Products Co.....132

Reade Mfg. Co.....108
Robbins & Meyers, Inc..... 69
Rome Electrical Company, Inc..132
Rome Wire Company..... 16
Royal Metal Mfg. Company....118
Rubicon Co., The.....126
Ruby Chemical Co., The.....108

Scranton Button Co., The..... 83
Shakeproof Lock Washer Company 11
Shaw Insulator Company..... 94
Sherman Mfg. Co., H. B.....129
Shimer & Sons, Samuel J..... 67
Signal Elec. Mfg. Co.....128
Sorgel Electric Company.....127
Standard Alloy Wire Co., Inc.. 132
Star Porcelain Company, The...105
Steinen & Company, William...104
Stewart Die Casting Corp., The 79
Sticht & Co., Herman H..... 90
Strand & Co., N. A.....128
Sundh Electric Company, Inc..86-133
Synthane Corporation 99

Technical Products Co..... 84
Thomas & Sons Co., The R....103
Thordarson Elec. Mfg. Co.....114
Torrington Co., The..... 14
Toycraft Rubber Co., The.....107
Trotter & Co., E. T.....139
Twin City Die Castings Co..... 84

Udylite Process Co., The..... 8
Union Electric Mfg. Company..127
United Chromium, Inc.....115
Universal Winding Company....134

Vim Electric Tool Co.....132

Walser Automatic Timer Co...129
Waterbury Button & Moulding Co. 99
Waukegan Chemical Company.. 96
Western Felt Works..... 88
Westinghouse Elec. & Mfg. Co... 71
Weston Elec'l Instrument Corporation 127
West Virginia Pulp & Paper Co..139
Wheeler Insulated Wire Co., The 116
Wiegand Co., Edwin L..... 65
Wilcolator Company, The.....126
Wilmington Fibre Specialty Co.. 95
Wilson Co., The H. A.....131
Wire Stripper Co., The.....132

York Insulated Wire Works of General Electric 131
Young Brothers Co.....135

Zapon Company, The...Front Cover
Zeller Lacquer Mfg. Co., Inc...137

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Sheet Metal Screws

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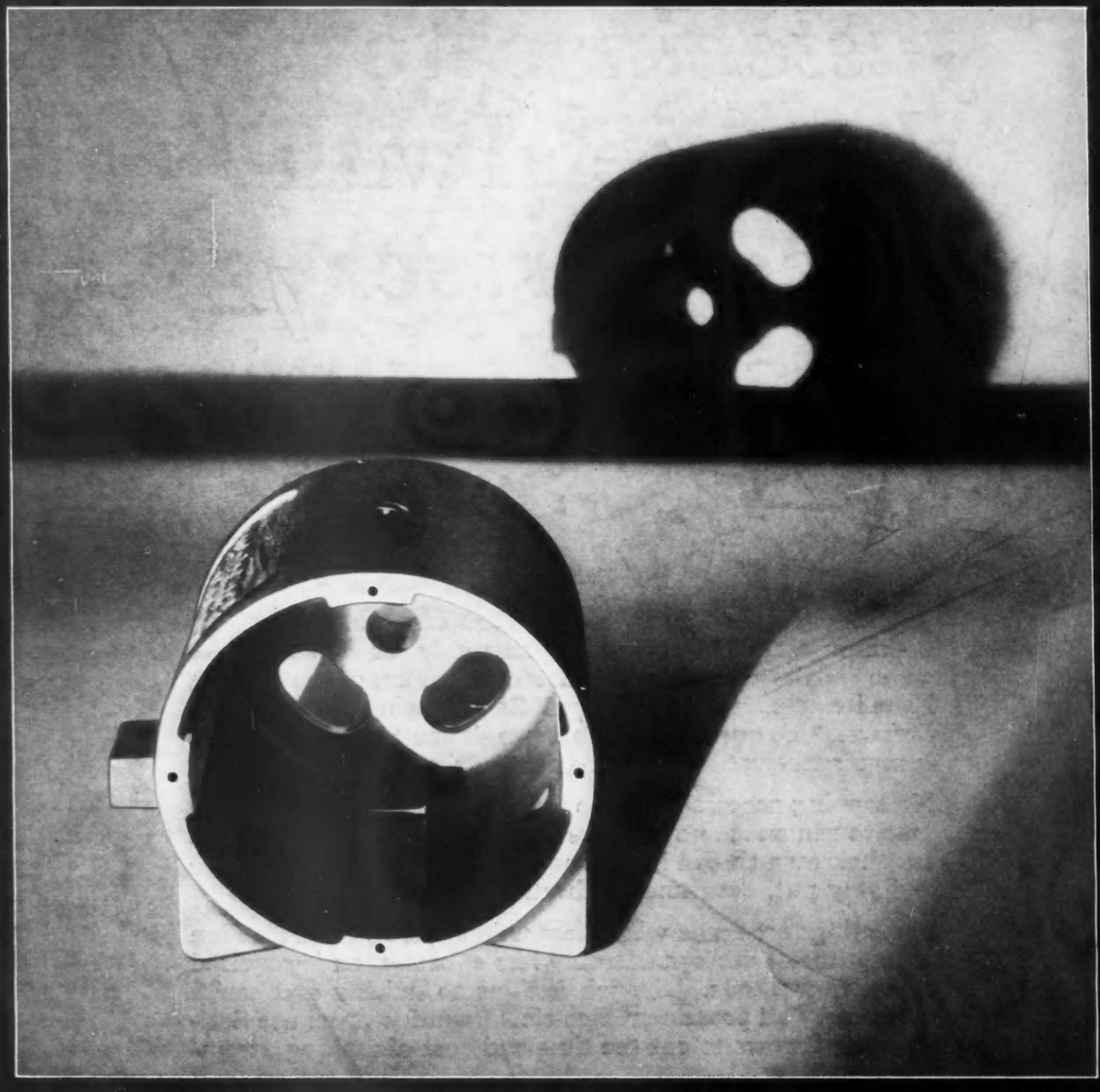

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